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U S NAVY RESPONSE TO REGULATOR COMMENTS TO DRAFT FEASIBILITY STUDY REPORT BUILDING 81 SITE WITH TRANSMITTAL NAS SOUTH WEYMOUTH MA
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August 20, 2012

Project Number G02073

Mr. Brian Helland, RPM
BRAC PMO, Northeast
4911 South Broad Street
Philadelphia, Pennsylvania 19112

Reference: CLEAN Contract No. N62470-08-D-1001
Contract Task Order (CTO) No. WE11

Subject: Responses to Comments, Draft Feasibility Study Report
Building 81 Site
Former Naval Air Station South Weymouth, Weymouth, Massachusetts

Dear Mr. Helland:

Tetra Tech, Inc. has prepared responses to comments (RTCs) received on the draft Feasibility Study (FS) Report for the Building 81 Site, Former Naval Air Station South Weymouth, Weymouth, Massachusetts. Comments were received from the U.S. Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (MassDEP), LNR South Shore LLC, and Advocates for Rockland, Abington, Weymouth and Hingham. The draft final FS will be prepared once the RTCs are reviewed and accepted.

On behalf of the Navy, the RTCs on the Building 81 draft FS are being provided to the recipients listed below. If you have any questions regarding the document, please contact me at (978) 474-8403.

Very truly yours,

Phoebe A. Call

Phoebe A. Call
Project Manager

PAC/lh

Enclosures

c: D. Barney, Navy (w/encl. – 1)
C. Keating, EPA (w/encl. – 3)
D. Chaffin, MassDEP (w/encl. – 1)
P. Steinberg, Mabbett & Associates, Inc. (w/encl. – 1)
P. Sortin, Abington (w/encl. – 1)
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M. Parsons, Rockland (w/encl. – 1)
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Public Library, Hingham (w/encl. – 1)
Chief Executive Officer, South Shore Tri-town Development Corp. (w/encl. – 1)
R. Daniels, LNR Property Corp. (w/encl. – 1)
J. Logan, Tetra Tech (w/encl. – 1)
J. Trepanowski, Tetra Tech (w/o encl.)
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File G02073-3.2 (w/o encl.);
G02073-8.0 (w/encl. - 1 each)

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NAVY RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
COMMENTS DATED JUNE 11, 2012
DRAFT FEASIBILITY STUDY – BUILDING 81
FORMER NAVAL AIR STATION (NAS) SOUTH WEYMOUTH, MASSACHUSETTS

The Navy's responses to the EPA comments on the Building 81Draft Feasibility Study (dated April 2012) are presented below. The EPA comments are presented first (in italics) followed by the Navy's responses.

GENERAL COMMENTS

1. *The FS offers a number of interesting and potentially effective alternatives for remediating Building 81. There a number of issues, however, detailed in the following comments, which suggest that the remedial alternatives need to be reconfigured in order to be successful. Additional remedial alternatives also need to be considered. In particular, given the uncertainties regarding plume extent in bedrock, magnitude and locations for potential ground water extraction for irrigation, and (perceived) desire to limit the extent of LUCs (on the part of the redevelopment partners) , strong consideration should be given to remedial alternatives which rely on extraction, particularly for the bedrock plumes. For example, conventional pump and treat should be considered, at least for the bedrock plumes. Such a remedial alternative or remedial component, if properly designed, would prevent continued uncontrolled offsite migration of contaminant within bedrock, and at best may dramatically shorten restoration timeframes, particularly if efforts are made to target high-concentrations zones potentially suggestive of DNAPL.*

Response: The Navy evaluated groundwater extraction and screened it out as a general response action for reasons outlined in Table 3-1 of the draft FS. A conventional pump and treat methodology would generate large quantities of water and long-term operation of a treatment plant would be required. Not only would groundwater extraction be a costly alternative but also options for disposal of treated groundwater are extremely limited. In addition, a pump and treat alternative would impact the planned re-use of the area. If DNAPL is present, conventional pump and treat methodology would likely have limited effectiveness (due to a reduced dissolution rate). The Navy is pursuing other more cost-effective alternatives for remediating the B81 site.

2. *The paucity of data available to characterize the contaminant plumes and to estimate times to achieve the remedial goals makes the uncertainty in the characterization unacceptable and makes the modeling efforts nothing more than a guess. There is insufficient data available to reasonably estimate source decay and the ominous likely presence of DNAPL creates significant uncertainty regarding times to cleanup. That having been said the need to get a remedy in place is understood and what Navy has proposed could be workable although there is a great deal of uncertainty related to the design such that a more conservative approach should be presented and contingency plans should be developed as Navy works diligently and quickly to supplement the chemical database for this site.*

Response: Biochlor, a "screening" model, was used to evaluate natural attenuation of chlorinated solvents in the subsurface. It is based on both site-specific information from wells sampled in 2006 and estimates. A source release time and concentration at that time were assumed so that the source decay rate can be estimated to the measured concentrations from the RI. A section on Uncertainties will be added to Appendix E (Natural Attenuation Modeling).

Four groundwater domains were investigated as part of the 2009 Supplemental RI, which was developed with input from both EPA and MassDEP. The Navy believes that the Site is adequately and sufficiently characterized in nature and extent and that the impacted groundwater in most of the groundwater domains is adequately bounded by wells that show concentrations less than the MCL for PCE. Concentrations are well constrained in the deep bedrock with the exception of the area south of MW-35D. The EPA agreed that the site characterization was sufficient to support a Feasibility Study, with the understanding that the current monitoring network will need to be augmented and a comprehensive long-term monitoring strategy will need to be developed. The Navy anticipates that additional permanent wells will be installed and groundwater data collected to establish current conditions in support of the remedial design and long-term monitoring program. The Navy is not planning to supplement the chemical database for this site during the FS. The FS is intended to provide a conceptual description of remedial alternatives.

3. *Underground Utilities - The potentially significant and complicating role of underground utilities is of critical importance to successful remediation of the Building 81 plume. The situation at Building 81 now is akin to the Building 82 investigation, before the important role of the storm sewers at that site was fully understood. It should be recalled how drastically the understanding of the groundwater flow system changed at B82 once the role of the storm sewers was determined. Despite this situation, such information has not yet been evaluated carefully with respect to either the RI or the FS at Building 81. Consistent with EPA's previous comments on the subject, it remains our contention, until other information comes to light, that the extensive and "massive" utility corridor on both sides of Shea Road likely has an important effect on ground water movement and plume migration. The shallow depths to bedrock and high water table strongly suggest that the buried utilities may be playing a significant role. These utility alignments may be serving as unmonitored preferential pathways which may facilitate off-site transport of contaminants in groundwater and/or the vapor phases. Lastly, it is not clear whether or not these utility corridors, particularly the storm drain system, may work geochemically at cross purposes to the proposed bio barriers. These issues are discussed further in comments, below. Clearly a greater level of understanding regarding the role of underground utilities is needed before remedial scenarios can be adequately evaluated, even conceptually. It is incumbent on the Navy to furnish detailed plans which establish the locations, depths, and other pertinent as-built details of all subsurface features at the site and adjacent areas. As noted in the comments below, current efforts to supply utility information have fallen short of the mark.*

Response: As part of the effort to develop a more complete site conceptual model, the Navy investigated the role of the underground utilities in groundwater movement and plume migration during the RI. In 2006, utility drawings were reviewed, utility locations were confirmed using ground penetrating radar, and groundwater profiling was performed at multiple points and depth intervals (including the water table interval) north, south, and west of the B81 slab. The deepest utilities include the storm drain (approximately 8 to 10 feet below grade) and the communication manways (approximately 10 feet below grade) at the corner of Redfield Road and Shea Drive. Utility lines are mapped on Figure 1-3 in the RI. No contaminants were detected in the water table interval at any of the groundwater profiling stations. Elevated PCE concentrations were detected in the deep overburden, but this interval is below the depth of the subsurface utilities. In 2009, additional wells were installed with input from EPA and MassDEP to determine if preferential pathways for plume migration potentially exist north, south, and west of the former Building 81 slab. In the water table interval, PCE concentrations were either below the detection limit or less than 1 μg/L in the vicinity of several of the utility lines. This suggests that either contamination has not reached the utilities in the shallow overburden or the utility lines may not be influencing the transport of contaminants in groundwater. An example of the latter suggestion was found at MW-43S, where a low level of PCE (less than 1 μg/L) was detected in the shallow overburden northwest of the source area, north of the storm drain line. Based on this single finding, the utility line does not appear to have influenced/redirected the transport of contaminants in this direction. However, additional work along the storm drains may be warranted to confirm this finding.

Although the buried utility lines and the bedding for the utility lines could act as a preferential pathway for contaminants in the vapor phase, the concentrations of contaminants in the shallow groundwater are too low to be a source of vapor phase contaminants.

The Navy will perform additional work along the subsurface utilities in support of the remedial design to clarify the hydraulic effects of these utilities and determine if they are serving as preferential pathways for off-site contaminant migration in the aqueous or vapor phases. The influence, if any, of the subsurface utilities will also be considered in the development of the long-term monitoring program.

4. *Extent of Plume (Overburden) - As suggested in previous EPA comments, it is perhaps not a coincidence that the overburden ground water plume extent more or less coincides with the general location of buried utilities, particularly the N-S alignment along Shea Road. Additional detailed investigation is needed to clarify the hydraulic effects of these utilities as well to determine whether they are serving as preferential pathways for contaminant migration in the aqueous or vapor phases. A more highly resolved shallow well network is needed in these areas to determine the ground water component. Passive vapor sampling technologies should strongly be considered in the shallow subsurface to assess potential vapor migration within the utility corridors. A large number of inexpensive points (e.g. screening level data) should be conducted as a first step using time-integrated flux-based technologies.*

Response: Please refer to the Response to Comment No. 3 regarding the utility concern.

The Navy anticipates installation of additional wells and collection of additional groundwater data to establish current conditions in support of the remedial design and long-term monitoring program.

Soil gas and sub slab vapor sampling activities were conducted beneath the former B81 slab during the RI. Vapor intrusion risks to future residents and future construction workers were identified in the HHRA based on the RI data. Off-site utility corridors were not evaluated for vapor migration. The Navy will consider performing vapor surveys during the remedial design phase and the long-term monitoring program to monitor for organic vapors in storm drain manways, sewer manholes, catch basins, and utility access points at and around the site using direct read instruments. Additionally, passive vapor sampling will be considered to assess whether the utility alignments are serving as potential preferential pathways that may facilitate off-site transport of contaminants in the vapor phase.

5. *Extent of Plume (Bedrock) - There is a strong technical argument to be made that the bedrock plume, particularly in deep bedrock, is not bounded to the south. This has profound implications for the effectiveness of site cleanup, not to mention reuse/redevelopment options to the south.*

Response: There appears to be evidence of a southerly component of flow and contaminant transport via a fracture(s) south of MW-3D. The plume boundary is not constrained south of MW-35D. The Navy will consider installing an additional deep bedrock well south of MW35D in support of the remedial design and long-term monitoring program to delineate the boundary of the plume in this direction.

6. *Geographical extent of LUCs – Upon further evaluation, the LUC boundaries provided in the FS are likely insufficient in that they do not adequately account for the potential for a greater southerly current extent and/or future southward migration of contaminants in the groundwater and/or vapor phases via underground utilities and/or within bedrock. It would be advisable to develop a series of active remedial alternatives that invoke ground water extraction as a component, particularly in the high concentration source areas in bedrock. Alternatively, a base-wide LUC could be put into place which calls for passive vapor barriers for all new construction and vapor mitigation strategies for existing construction.*

Response: Groundwater extraction has been screened out as a general response action for a variety of reasons (see the Response to Comment No. 1). The Navy will develop a LUC remedial design during the remedial design phase that will define the boundaries of the interim and permanent LUC areas as well as objectives, conditions, and terms of the controls. Should data collected in support of the remedial design show concentrations in groundwater and vapor phases above accepted criteria, the LUC boundaries outlined in the FS may need to be refined. Consideration of a base-wide LUC for passive vapor barriers is excessive given the limited extent of shallow VOC-contaminated groundwater. LUCs are established on a site-specific basis considering the contaminants present and controls needed.

7. *Bio barriers - The bio barriers are an interesting concept which should be further examined. However, it may be necessary to consider alternative geometries or implementation strategies. A key concern lies with the geochemical compatibility of the bio barriers with the underground utility corridors just to the west of the proposed bio barrier locations. By design, the bio barriers create a*

highly anoxic condition in the ground water, favoring reductive dechlorination of CVOCs. However, the buried utility corridors, particularly the storm sewers, also by design, transport high volumes of oxygenated surface water runoff. As such, it is likely that anoxic groundwater down gradient of the bio barriers may with interact with oxygenated water within or in the vicinity of the utility trenches. More significantly, the short distances between the proposed bio barrier locations and the utilities suggest that such interaction may be abrupt, within a narrow region of the subsurface. This suggests two potential problems. Of primary importance is the fact that the reduced zone down-gradient of the trenches will not be allowed to expand fully, thus limiting treatment effectiveness. Secondly, the abrupt juxtaposition of groundwater from radically different geochemical regimes, without the spatial and temporal opportunity for mixing, may result in extreme metals precipitation issues which may interfere with the functionality of the utilities, if not the bio barriers, not to mention potentially plugging the pore space in monitoring wells and the aquifer itself beneath portions of the site. This issue needs careful examination. As a first step in this process, EPA recommends constructing a series of scale engineering drawings which locate the as-built utilities in relation to the proposed bio barriers laterally and vertically so that the potential for counterproductive geochemical interactions may be more fully evaluated.

<u>Response:</u> Bio barriers are components of alternatives G-2, G-3, and G-4. These issues/concerns will be carefully considered during the remedial design process. To the extent possible and based on available information, engineering drawings will show the proposed bio barriers in relation to the subsurface utilities.

The potential impacts of the buried utilities are not expected to be significant. The greatest concern will be avoiding the piping during drilling. Storm sewers normally have no flow. If there are leaks, the discharge from the leaks would be temporary during rain or snow melt. In any case, oxygenated rainwater is always introduced to the groundwater by way of percolation of precipitation through the ground. Also note that the dissolved oxygen (DO) concentration in the precipitation is limited to approximately 10 mg/L, and this DO will be subsequently diluted. Considering the limited amount of DO that would be introduced to the groundwater compared to the mass of electron donor (ED) added in the barrier, the DO input is not significant. Also note that DO is considered in the design of the bio-barriers.

Even if the additional DO reacts with iron in the groundwater, it is unlikely that the additional DO will penetrate very far into the groundwater because the additional DO is being applied at the surface of the water table.

It is highly unlikely that the functionality of the utilities would be affected by the biobarriers. The inverts of the utilities appear to be above the water table. Even if temporary high water table conditions occur during severe rainfall events, the quantity of the solids generated by biobarrier reactions that could enter or precipitate in the storm sewers would not be large enough to affect the flow.

8. *Please clarify how the bio-barriers will be protective of downgradient receptors. Based on the calculations provided in Appendix D it appears that the bio-barriers are designed based on the half-life of PCE suggesting that daughter products of PCE generated in the bio-barriers may migrate downgradient of the bio-barriers without a significant reduction in concentration through the bio-barriers. If adequate reduction of the concentration of these daughter products is anticipated by Navy either through the bio-barriers or downgradient of the bio-barriers please supplement the FS to support that assumption.*

<u>Response:</u> Treatment of contaminants is continuous through the barrier. TCE that is created from the breakdown of PCE will then react to cis-1,2-DCE, and then to vinyl chloride and ethene. The biobarrier design accounts for reaction of TCE through to ethene.

9. *Deliverability Issues/Injection Performance Monitoring - The FS needs to fully acknowledge the fact that "deliverability" of reagents to the subsurface is an integral part of the "technology", and that successful remediation is dependent on ability to <u>deliver</u> injected materials to the appropriate locations. Regardless of what type of constituent which are proposed to be injected into the*

subsurface, a more comprehensive evaluation of the <u>deliverability</u> issues pertaining to the particular material(s) is needed. The FS relies on assumptions in this regard which do not appear to be well developed. Since all of the active remedial components thus far developed for the FS rely on injections, it will be necessary to provide additional details concerning the design basis for injection, e.g., method, spatial density, pressures, etc. Most importantly, it will be necessary to perform real-time performance monitoring of injections in order to demonstrate that injected materials have been placed to appropriate locations and depths in the subsurface. Based on past experiences, at this site and others, EPA does not consider this to be a "minor" issue that can be ignored until the design phase. The revised version of the FS should provide pertinent details in this regard, if they can be determined. If not, a pilot study should be developed which seeks deliberately to demonstrate ability to deliver injected materials to targeted locations. Both direct and indirect methods of performance monitoring of injection should be included. Borehole and surface geophysical methods (e.g., electromagnetic (EM) and direct-current resistivity) may be successful in evaluating <u>deliverability</u> of permanganate. A recent technical paper entitled, Time Series Geophysical Monitoring of Permanganate Injections and in situ chemical oxidation of PCE, OU1 area, Savage Superfund Site, Milford, NH, USA, P. Harte et. al., Journal of Contaminant Hydrology, February 1, 2012, is attached and illustrates the use of such methods at another Superfund site in Region 1. The Navy should contact the vendors for EOS and any other potential materials to be injected at the site in order to determine approaches (direct and indirect) which have proven successful in the past for establishing appropriate <u>deliverability</u> of these materials. See additional, page-specific comments, below.

<u>**Response:**</u> The ability to distribute the injected material is an acknowledged issue. It was noted in the text, for example on page 4-9, that a pilot study would be performed for the reasons noted in the subject comment.

Injection of EOS into the overburden has been demonstrated at many sites. For the bedrock, there is much more uncertainty, but as noted, a pilot study would be required.

In the previous ISCO pilot study, reagent was injected into the bedrock with mixed results. Some borings were able to accept large quantities of reagent and some could not. The amount of material that could be injected at a given borehole was a function of the number and extent of fractures, and this is uncertain until the time of injection.

10. *Induced Fracturing - The ISCO approach outlined in the FS appears to rely on inducing fracturing in shallow and deep bedrock units in order to deliver oxidants into the tight granite bedrock. However, no specifics are provided in either the report or supplementary documentation provided in the appendices. While EPA believes that ISCO may have merit as a remedial component for B81, additional detail is needed so that the deliverability approach with respect to ISCO can be properly evaluated. Please see also, general comment above, Deliverability Issues/Injection Performance Monitoring, and specific comments below pertaining to Appendix D.*

<u>**Response:**</u> Hydrofracture emplacement of a potassium permanganate and sand blend is an innovative approach to deliver oxidants to low permeability media such as clay and bedrock for a sustained treatment of source zone contamination. The conceptual design presented in the FS is based on data currently available and subcontractor experience in similar site conditions. Detailed design and performance monitoring will be determined in the remedial design if this alternative is selected.

11. *A potential fault with the proposed treatment zone designs is that Navy does not have sufficient data to know where the maximum concentrations of PCE are located and Navy has not proposed conservative enough designs (aerial coverage) to account for this uncertainty. As stated above, there is uncertainty related to the groundwater flow paths in the bedrock treatment intervals. Navy needs to adjust the proposed treatment designs in this FS to account for the inherent uncertainty and also collect additional rounds of groundwater data prior to implementing the selected remedy so the design can be refined as necessary prior to implementation.*

Response: As noted in the final RI, most of the maximum PCE concentrations were reported in groundwater samples collected during the 2006 Phase II RI field effort. The Navy anticipates collection of additional groundwater data to establish current conditions in support of the remedial design and assist in the preparation of the long-term monitoring program. While additional samples can be collected prior to the final design, note that the proposed treatment zones are based on the concentrations described in the RI to identify the extent of contamination. There are few locations with significant PCE concentrations (that is, greater than 1,000 µg/L) which suggests that the treatment zones should be small. In any case, most of the high concentrations are in the bedrock, and treatment in this area is expected to be difficult due to the uncertainties of the distribution of the treatment chemicals.

12. *Based on the contaminant migration velocity at the site and review of Figure 1-14, a significant volume of deep overburden groundwater with PCE concentrations in excess of 200 µg/L may have already bypassed the proposed location for the bio-barriers. Please supplement the FS to demonstrate that the contaminant concentrations that have or will have by-passed the bio-barriers will not cause excess risk to downgradient receptors.*

Response: Contaminants in groundwater downgradient of the biobarrier will be addressed by MNA and LUCs.

13. *A more aggressive treatment alternative or contingency plan may be warranted by including hot spot treatment or additional treatment fences between the treatment areas and the existing bio-barrier rows to reduce the required remediation time or to prevent the migration of PCE beyond the proposed LUC boundaries at concentrations exceeding the cleanup goals. Some discussion to this affect for plume migration to the south and northwest should be included in the text discussion*

Response: Based on the existing data, there do not appear to be any other hot spots. The 1,000 µg/L PCE contour was used as the target treatment zone, and takes into account the potential for DNAPL based on 1 percent of the solubility of PCE. (Solubility of PCE is 200,000 µg/L, so 1% is 2,000 µg/L.) Groundwater migration appears to be to the west which is consistent with the groundwater flow direction, so no other treatment zones were considered. If the treatment zone was expanded in to the 500 µg/L PCE area, the costs will increase proportionally. However, the potential decrease in overall remediation time does not appear to be justified by the added expense. The bio-barrier alternatives provide containment and source area treatment.

14. *Please clarify what single vertical datum Navy intends to use for this report and for work on this project. Figures 1-2, 1-3, and 1-4 use NGVD 1929; Figures 1-5, 1-6, and 1-7 refer to feet above mean sea level; and Figure 1-8 through 1-16 use NAVD 1988. Please correct the figures as appropriate to reference a single vertical datum.*

Response: Please note that the FS Section 1 figures are all from the RI and are included in the FS to support the site background information discussed in Section 1. The Building 81 RI and FS use the NAVD 1988 vertical datum. As noted in the comment there are inconsistencies in the vertical datum in some of the figure notes and elevation references. However, the information on the figures is otherwise appropriate for the purposes of the FS. Since the figures are included in the final RI, they will not be changed for the FS. The NAVD 1998 will be used in the remedial design where appropriate for consistency with the RI and FS.

For future reference however, please ignore Note 4 on Figures 1-2, 1-3, and 1-4 as it is not applicable; and please ignore 'above mean sea level' on Figures 1-5, 1-6, and 1-7. The correct vertical datum is referenced on Figures 1-8 through 1-16 (NAVD 1988).

15. *Please explain the reason for the shape of the 1998 excavation; was a building or other structure formerly located there? Also, what was the original purpose for the former underground storage tank*

Response: Information regarding the former UST is presented in Section 1.2.2 of the FS and Section 1.3.4 of the RI. Information pertaining to the 1998 excavations is presented in Section 1.2.3 of the FS and Section 1.4.7 of the RI. No buildings were formerly located in excavation areas.

16. *Please clarify whether or not the FS has taken into account the latest toxicity data for TCE and if not please update the risk calculations to account for this recent information.*

Response: The latest toxicity data for TCE were previously taken into account for the construction worker PRGs. The vapor intrusion PRGs for recreational users (e.g. commercial/industrial) and residents will be revised to account for mutagenic effects of TCE, and these PRGs will incorporate the latest toxicity data for TCE.

PAGE-SPECIFIC COMMENTS

17. *Page 1-3, § 1.2.1 - Please change "1,442 acres" to "1,440 acres" in the first sentence to be consistent with the recently issued Building 82 FS (assuming the latter is the correct value).*

Response: Please note that the text states 'approximately' 1442 acres which is also the acreage referenced in the SRA FS. In some cases, such as the Building 82 FS, this has been rounded to 'approximately' 1440 acres. As the acreage is approximate, no change will be made.

18. *Page 1-7, § 1.3.1, ¶ 1 – In addition to the identifying the depth of the unconsolidated overburden materials at the Site, please provide specific depths for the shallow and deep overburden (referenced in subsequent discussions, specifically in Section 2.0).*

Response: Section 1.3.1 provides general descriptions of the overburden units and bedrock encountered during field investigations at the site. Additional details can be found in the Building 81 RI Report. The terms shallow and deep overburden and shallow and deep bedrock were created when each measured monitoring well was grouped into one of four groundwater domains in preparation of groundwater contour maps. These four domains are summarized below and described in detail in the RI Report. This information will be added to Section 1.3.2 of the FS.

- The shallow overburden groundwater contour maps were prepared using water level measurements from wells with screened intervals beginning at less than or equal to 7 feet below ground surface (ft. bgs).
- The deep overburden groundwater contour maps were prepared using water level measurements from wells with screened intervals greater than 7 ft. bgs and less than 20 ft. bgs.
- The shallow bedrock groundwater contour maps were prepared using water level measurements from wells with monitored zones (either screens or open boreholes) beginning approximately 17 to 31 ft. bgs.
- The deep bedrock groundwater contour maps were prepared using water level measurements from wells with screened intervals beginning approximately 45 ft. bgs or deeper. Some of the deep bedrock wells extend as much as 120 ft. bgs. The deep bedrock open boreholes have monitored zones starting above 45 ft. bgs, but due to their overall depth in bedrock, these wells were not included on the groundwater contour map.

19. *Page 1-8, § 1.3.2, ¶ 1 – In addition to the identifying the depth to bedrock at the Site, please provide specific depths for the shallow and deep bedrock overburden (referenced in subsequent discussions, specifically in Section 2.0).*

Response: Please see the Response to Comment No. 18.

20. *Page 1-10, § 1.3.5, ¶ 1 – While the highest concentrations of VOCs are present in the deep overburden and shallow bedrock zones, what is the likely source of the 2,800 ug/L(1800 ug/L) detections in MW-030, which is in a deep bedrock zone? These detections do not appear to be associated with the former waste oil tank given the direction of groundwater flow near or downgradient of the tank. Is it possible these detections could be attributed to separate, upgradient*

source or that the groundwater contamination at the Building 81 site is commingled with a deep, groundwater plume emanating from an upgradient source? Please explain.

<u>Response</u>: While the overall groundwater flow direction at the site is toward the west-southwest, there also appear to be localized components of flow in several of the geologic units. A northwest component of flow is most pronounced in the deep overburden and shallow bedrock and a south-southwest component of flow is evident in deep bedrock. Consequently, northwest projecting plume lobes of contamination are present in deep overburden and shallow bedrock. A southward projecting plume lobe is present in deep bedrock. Contamination migrated through overburden, into shallow bedrock, and then into deeper bedrock likely via vertical and high angle fractures and through long boreholes that remain open. Some of these fractures are transmissive and some are not; some transport contaminants while others do not. If deemed necessary additional information may be collected at the remedial design phase to better understand the orientation and interconnectivity of the fractures to the northwest and to the south-southwest.

The Navy believes the source of contamination at B81 is attributable to past waste oil releases from or around the former UST. The Navy has no data to support the premise that there could be a potential separate upgradient source or that the groundwater contamination at the Building 81 site is commingled with a deep, groundwater plume emanating from an upgradient source.

21. *<u>Page 1-12, § 1.3.6</u> - The discussion of DNAPL in the third paragraph under VOCs makes assumptions that are not warranted based on the available data. The presence of PCE at a concentration of 11,000 µg/L in groundwater (5 to 7 percent of solubility) is a clear indication that DNAPL is very likely present in the subsurface. Navy's assumption that the mass and extent of DNAPL is limited has no basis in fact due to the limitations in the available sampling data and needs to be deleted.*

<u>Response:</u> The Navy is aware that DNAPL is potentially present in the bedrock in a portion of the site. Based on available groundwater data, concentrations of PCE exceeded 1 percent pure phase solubility at only two locations – BR-07 and MW-3D. The extent of the potential DNAPL mass <u>appears restricted</u> to these locations, which may be hydraulically connected through vertical or high angle fractures in the bedrock and through long boreholes that were drilled in 2000 and remain open. The amount of PCE released at the site is unknown. The Navy believes the potential mass <u>could be</u> small and trapped in hydraulically isolated fractures.

The Navy plans to monitor these wells and the surrounding area as part of the long-term monitoring program.

22. *<u>Page 2-1, § 2.0, ¶ 2</u> - It is stated that "LNR South Shore LLC (LNR), have indicated that potable and irrigation water needs for the redevelopment can be provided by sources other than the groundwater under the Building 81 Site (SSTTDC/LNR, 2011). Therefore, future uses of Site groundwater for potable or irrigation purposes are not exposure scenarios that will be evaluated in the FS." Since these potential risks are not evaluated, these risks must be prevented by institutional controls that will prevent use of groundwater under the Building 81 Site for any purpose. In addition, since pumping elsewhere on the base could draw contamination toward that water source, any such pumping should be prevented by institutional controls subject to a technical demonstration that such pumping would not expand the area of groundwater contamination.*

<u>Response:</u> Agreed. LNR agreed to a permanent LUC that would restrict extraction of groundwater for production, supply, or irrigation uses after the draft FS was issued. This permanent LUC is described in Section 4 of the FS. The two sentences quoted in the comment will be revised as follows: "…LNR South Shore LLC (LNR), have indicated that production, supply, and irrigation water needs for the redevelopment can be provided by sources other than the groundwater under the Building 81 Site. Therefore, future uses of Site groundwater for production, supply, or irrigation purposes are not exposure scenarios that will be evaluated in the FS. Land use controls (LUCs) to restrict use of groundwater are included in the alternatives discussed in Section 4 of this FS." LUCs are site-specific and therefore the need for LUCs in other portions of the base is not discussed in this FS.

23. *Page 2-1, § 2.0, ¶ 2 – In the last sentence, please replace, "for potable or irrigation purposes" with "for production, supply or irrigation purposes."*

Response: Agreed. The noted change in wording was agreed to after the April 2012 draft FS was issued.

24. *Page 2-2, § 2.2, ¶ 2 – In the first sentence, please replace, "as a potable or irrigation water supply" with "as a production, potable or irrigation water supply."*

Response: Agreed. The noted change in wording was agreed to after the April 2012 draft FS was issued.

25. *Page 2-6, § 2.4.1 – For consistency with the November 8, 2011, Proposed Approach for the Building 81 FS, please amend the list of exposure scenarios to include the following:*

- *Potential exposure to groundwater under the reasonably foreseeable future land use scenarios for the Site (recreational, institutional, commercial, office, retail and residential uses);*

Response: The exposure scenarios listed in Section 2.4.1 of the FS are consistent with the discussion in the November 8, 2011 Revised Proposed Approach for the Building 81 FS. The stated exposure scenarios represent the most conservative receptor in each zoning district: e.g., recreational user in the RecD zone (which includes indoor commercial recreational facilities); and resident in the VCD zone (which also includes commercial and institutional uses). Please note that the SSTTDC definition of commercial uses includes retail and office space.

26. *Page 2-8, §2.6.1- See comment 20. above.*

Response: The text in Section 2.6.1 will be revised as follows:

"The PCE plumes in the overburden (water table interval and deep overburden intervals) begin just west of the former waste oil UST, with the easternmost detections at MW-02S (0.19 µg/L) in the water table interval and I-15 (1.5 µg/L) in the deep overburden. The plumes extend primarily toward the west-southwest, consistent with the overburden groundwater flow direction. The highest concentration in the water table interval (100 µg/L in 2006) is located between the former tank grave and the building footprint. Based on available data, the PCE plume in the water table interval has not migrated beneath Shea Memorial Drive. The highest concentration in the deep overburden (360 µg/L in 2006) is located downgradient of the former tank grave, near the northwest corner of the building footprint and significantly decreases on the west side of Shea Memorial Drive. PCE was detected at concentrations up to 2 µg/L, as far west as the Transportation Building (MW-48I). This is likely the leading edge of the plume in the deep overburden. Both plumes are bound to the north by Redfield Road and to the south between the building footprint and Building 140. A lobe of the PCE plume in the water table interval extends northwest toward MW-43S, on the north side of Redfield Road. In the deep overburden, a small lobe of the PCE plume extends northwest toward MW-38I. The outline of the PCE plume at various depths is depicted on Figures 1-5 through 1-7. The PCE concentration contours in the water table interval and deep overburden are depicted on Figures 1-13 and 1-14.

The PCE plume in shallow bedrock has a similar general east-west orientation as in the deep overburden, but the shallow bedrock plume is not elongated to the southwest. The PCE plume in shallow bedrock extends farther east than the overburden plumes, with the eastern-most detection at BR-08 (15 µg/L). The northern extent of the PCE plume is similar to the overburden plume, but the southern extent is greater. A low concentration of PCE (0.835 µg/L) was detected at MW-50B in the shallow bedrock. Similar to the PCE plumes in overburden groundwater, a lobe of the PCE plume extends northwest in shallow bedrock toward MW-38B. The highest PCE concentration in shallow bedrock was reported in the sample from BR-07 (11,000 µg/L). All of the other detected concentrations of PCE were below 650 µg/L. There appears to be a fracture zone or preferential pathway south-southwest of BR-07 toward BR-21.

The PCE plume in deep bedrock groundwater has the same general orientation as in the shallow bedrock, but the deep bedrock plume is much narrower in the middle and is more limited in extent. The maximum PCE concentration in deep bedrock groundwater, 1,600 µg/L (2,800 µg/L in 2006), is located at MW-03D. PCE was also detected in the collocated deep bedrock well at MW-3D2, screened in the deepest monitoring portion of bedrock (110 to 120 feet bgs), but the concentration was less than 1 µg/L. PCE concentrations were lower in the deep bedrock than the shallow bedrock. As noted in the shallow bedrock, flow in the bedrock appears to be very fracture dependent."

27. *<u>Page 2-8, §2.6.1</u>- Please insert "in the overburden" after "(maximum of 360 µg/L)" in the third sentence.*

<u>Response:</u> Please see the revised text in the Response to Comment No. 26.

28. *<u>Page 3-4, §3.2.2.1</u> - The reference to short-term LUCs in this section is inconsistent with the cleanup time requirements for the proposed alternatives and as such the reference is misleading. Please edit the text to more accurately portray the LUC requirements.*

<u>Response:</u> This section is intended to be a general discussion of potential technologies and processes. Details of the use of the processes and technologies in the alternatives are discussed in the subsequent section where the alternatives are developed. No changes will be made in Section 3.

29. *<u>Page 3-6, §3.2.2.1, Effectiveness</u> – While the "long time for remediation through natural attenuation processes" might prove "effective" in the absence of drinking water cleanup standards, it wouldn't be effective in meeting Groundwater RAO No 1. Please amend.*

<u>Response:</u> As noted in the response above, this section is intended to be a general discussion of potential technologies and processes. Alternatives are assembled from multiple technologies and discussed in Section 4 of the FS. A single process or technology is not required to meet all the RAOs. No changes will be made in Section 3.

30. *<u>Page 4-9, §4.2.2.1</u> - The discussion for the bedrock injection wells states that injection would occur over discrete 10-foot intervals along the entire screened length; however, the text does not indicate what screened length is planned. Please include that information.*

<u>Response:</u> The screen interval is assumed to be 18-40 ft bgs for injection wells in shallow bedrock and 18-60ft for injection wells in deep bedrock. The FS text will be revised to clarify this.

31. *<u>Page 4-11, §4.2.2.1</u> - The second paragraph discusses the anticipated remediation times; however, if DNAPL is present, as appears likely, remediation will take considerably longer than indicated in this paragraph. This needs to be acknowledged in the text.*

<u>Response:</u> Agree. In the presence of DNAPL, the cleanup time may be considerably longer than presented in the FS. The cleanup time estimate using Biochlor is based on the assumption that the source concentration is decaying exponentially and the corresponding first order decay rate was calibrated to the limited data available. The Biochlor model does not differentiate whether the source mass is NAPL or contaminants trapped in a low permeability zone such as clay or rock matrix that may act as a diffusive source. For either case, the groundwater concentration in the source zone may not decrease exponentially from source mass release. Due to limitations of the Biochlor model and the available data, the cleanup time estimates presented in the FS can and should only be used for a semi-quantitative comparison between different alternatives. The FS text will be revised to clarify this point.

32. *<u>Page 4-12, §4.2.2.1</u> - A more detailed discussion of the LUCs required needs to be presented;*

exposure to groundwater is not the only concern. The LUCs implemented must also prevent any use or impact on groundwater that would interfere with the functioning of the remediation system. For example, the LUCs must impose a boundary such that the radius of influence of any well constructed outside the LUCs in the vicinity of Building 81 does not impact the groundwater flow characteristics of the Building 81 plumes. Similarly, changes in the permeability of the ground surface that could potentially result in changes to the plumes' flow characteristics would have to be prevented or accounted for in the design. Please edit the discussion accordingly and insure that the LUC boundary selected satisfies these requirements. This comment is applicable to all the alternatives.

Response: The level of detail in the draft FS is appropriate for the evaluation of the various remedial alternatives. As noted in Section 4.2.2.1, details of the LUCs and their implementation will be included in the LUC RD which will be developed as part of the remedial design.

33. Page 4-12, §4.2.2.1 – As previously discussed, all references to "potable and irrigation" should be changed to "production, supply or irrigation"

Response: Agreed. The noted change will be made.

34. Page 4-12, §4.2.2.1 - b) It appears that the reference to Figure 4-1 in the first paragraph should be changed to Figure 4-2 because Figure 4-1 does not show the entire "permanent" LUC boundary whereas Figure 4-2 is strictly a LUC figure. Please confirm.

Response: Agree. The text will be revised to refer to Figure 4-2.

35. Page 4-12, §4.2.2.1, ¶ 2 – Please delete "(as a contingency)" in item 1. This was not included in the November 8, 2011, Proposed Approach for the Building 81 FS."

Response: Because Alternative G-2 does not include treatment, the phrase "(as a contingency)" was added to note that treatment is not planned as part of this alternative.

36. Page 4-12, §4.2.2.1, ¶ 3 – For reasons previously discussed, please delete "potable or irrigation" and replace with "production, supply or irrigation."

Response: Agreed. The noted change will be made.

37. Page 4-14, §4.2.2.2, ¶ 3 – For reasons previously discussed, please delete "potable or irrigation" and replace with "production, supply or irrigation."

Response: Agreed. The noted change will be made.

38. Page 4-14, §4.2.2.2 - The second last paragraph states that no treatment residuals would be generated; however, that is not clearly correct. In addition to the likely mobilization of metals due to the creation of reducing conditions in the groundwater, the text should also acknowledge that vinyl chloride is a daughter product of PCE degradation and is much more toxic than PCE. Furthermore, as indicated earlier in the FS, vinyl chloride does not readily degrade under anaerobic conditions so there is a possibility that it could accumulate in groundwater for some distance before geochemical changes in the groundwater allow it to be degraded aerobically. This same scenario creates a concern for the effectiveness of the remedy related to vapor intrusion concerns because the Village Center District (VCD) is located downgradient of the passive treatment area. The accumulation of vinyl chloride in groundwater at the VCD has not been evaluated by this FS or the HHRA. This comment is applicable to all the alternatives.

Response: Agreed. The text for each alternative will be revised to note that vinyl chloride might accumulate if conditions are not sufficient for anaerobic and/or aerobic biodegradation.

39. Page 4-15, §4.2.2.2 - The discussion in the first paragraph should be edited to clarify that the

BIOCHLOR modeling assumed a decaying source to arrive at the cleanup times presented in this paragraph. The presence of DNAPL in the subsurface would result in much longer cleanup times than indicated in this paragraph. In the shallow bedrock the presence of DNAPL is likely based on the elevated PCE concentration in groundwater and it cannot be discounted in the deep bedrock based on the limited amount of data available.

Response: Agreed. The text will be revised to acknowledge the limitations of the Biochlor model as described in the Response to Comment No. 31. The presence of DNAPL is suggested by the concentrations of PCE in two wells. However, there is no other evidence of DNAPL.

40. Page 4-17, §4.2.3.1 - In the fourth full paragraph on this page, please indicate what assumptions have been made and what calculations have been performed to support this secondary injection design. Please acknowledge that with DNAPL present this replenishment design will not be sufficiently effective.

Response: The amount of electron donor added for the first injection is estimated based on the demand of electron acceptors in the target treatment zone and the electron acceptor flux from upgradient groundwater with a safety factor to account for uncertainties in the actual performance, including the potential presence of NAPL. The second injection adds another layer of protection to ensure any remaining source mass could be further degraded and addresses the uncertainties. However, the electron donor quantity estimated in the preliminary design of the FS is only on a conceptual level for the alternative under evaluation. If this alternative is selected, details will be refined in the remedial design phase with further supporting information from pilot studies and baseline monitoring. The FS text will be revised to clarify this point.

41. Page 4-22, §4.2.4.1 - For clarity, please edit the second paragraph to indicate that a solid oxidant will be delivered to the bedrock and that it is the solid form of the oxidant that gives it a relatively long lifetime. Also, clarify how many pounds of oxidant, not just blend, will be injected into the bedrock.

Response: Use of a solid blend of potassium permanganate and sand by hydrofracture emplacement was described in detail in the third full paragraph on page 4-22. The benefit of using oxidant in solid form was briefly described in Section 3.2.4.2. The solid blend used by the vendor has approximately 50% of potassium permanganate in mass. The text will be revised to clarify the quantity of oxidant to be injected.

42. Page 4-22, §4.2.4.1 - The third paragraph states that no pilot study is needed because one was performed previously. Please clarify if the previous pilot study included hydrofracing. If not, please clarify how that pilot test is helpful in designing Alternative G-4.

Response: The text will be revised to indicate that a pilot study or phased approach would be used to further evaluate hydrofracturing.

43. Page 4-22, §4.2.4.1 - The fourth paragraph discusses the assumed effectiveness of the ISCO treatment. 99 percent reduction is assumed even though the previous pilot test was apparently not as effective as that based on earlier qualitative descriptions of the effectiveness of that test on CVOCs. In support of the information provided in this paragraph, please supplement this FS with a summary of the results of the previous pilot test using ISCO and the rationale for the assumed effectiveness presented in this paragraph.

Response: A higher reduction was assumed in the FS because of the closer spacing (10 feet) of injection points assumed for the alternative compared to the pilot study (mostly 20 to 30 feet). In addition, the permanganate is stable for a longer time and is expected to move further from the injection points, compared to the Fenton's reagent used in the pilot study. In addition, most of the reagent injected in the pilot study was likely consumed by reaction with the petroleum components from the waste oil. Please see Section 1.4.10 of the RI for a summary of the ISCO pilot test.

44. Page 4-25, §4.2.4.2 - In the first paragraph please clarify what the basis is for stating that no *treatment residuals would be created. Besides the likely mobilization of metals due to the creation of reducing conditions in the groundwater, it is likely that incomplete oxidation of chemical compounds would result in the creation of treatment residuals; the issue is whether or not those residuals would have a detrimental impact on MNA or contribute to groundwater risk that did not exist prior to treatment. There is uncertainty here that needs to be addressed in this discussion, so please edit the*

Response: The text will be revised to note that manganese and iron could be mobilized by the reducing conditions created by the bio-barrier, and that incomplete oxidation could create other contaminants. However, the products of incomplete oxidation would be treated through the bio-barrier and/or natural attenuation.

45. *Page 4-25, §4.2.4.2 - The discussion in under Short-Term Effectiveness please acknowledge that oxidation treatment is likely to destroy any existing microbiological populations in the treatment zone that may be currently metabolizing chlorinated hydrocarbons. This may or may not impact the effectiveness of these alternatives depending on the effectiveness of the oxidation treatment in reducing the chlorinated hydrocarbons to below remedial goals.*

Response: The potential adverse effects of ISCO on microorganisms are typically not permanent. The potential diminishment of microorganisms is noted on page 4-23. Such effects would be limited to a small area and the microorganisms are expected to recover in a short period of time,

46. *Table 2-3 - Please clarify why the construction worker PRGs in this table differ from the PRGs calculated and presented in Appendix B.*

Response: There was a calculation error in the spreadsheet included in Appendix B. The correct PRGs were presented in Table 2-3; however, the PRGs reported for the construction worker in Table 2-3 were previously based on an incremental lifetime cancer risk (ILCR) of $1x10^{-6}$ instead of $1x10^{-5}$, as the table indicated. The corrected calculation file for construction worker PRGs will be included in Appendix B, and Table 2-3 will be updated to present the construction worker PRGs based on an ILCR of $1x10^{-5}$.

47. *Table 2-4 - Assuming the sorbed masses of PCE presented in this table are reasonably accurate please clarify how the calculations presented in Appendix D account for this mass, which will ultimately be released to groundwater, when calculating the required mass of treatment chemicals to be injected.*

Response: The calculations for the bio-barriers account for the upgradient contamination, and the barriers will be maintained/replenished as long as is necessary. The travel time and upgradient mass were considered in the costing of the bio-barriers, and a safety factor is used in estimating the quantity of ED required.

48. *Tables 4-4, 4-7, and 4-10, Page 2 of 4 - The evaluation of the first line item, (e.g., MNA) states that all cleanup standards will be achieved within 30 years. This is contrary to information presented elsewhere in the FS and is not apparently correct. Please review and correct as appropriate.*

Response: The tables will be revised to match the times in the text.

49. *Table 5-1 - Page 1 - The text for the first criterion states that G-3 would require a longer cleanup time than G-4; however, elsewhere in the FS (page 2 of this table and Section 5.1.5) the time frames presented indicate that G-4 would take longer to reach the cleanup goals than G-3. Please review and correct or clarify as appropriate.*

Response: The table will be revised to match the text.

50. *Table 5-1 - Page 2 - The discussion of Short-Term Effectiveness for G-3 needs to be edited. The statement that there would be no adverse impact on the surrounding community or environment is not correct because this alternative is expected to mobilize metals into groundwater due to the creation of*

reducing conditions in the aquifer. Also, the second injection for the source zone would occur after 3 years (not 5 years) according to the detailed analysis section of the FS. Please review and correct as appropriate.

Response: The table will be revised to note the potential mobilization of manganese and iron. The table will also be revised as needed to address the timing of the second injection.

51. *Table 5-1 - Page 2 - G-4 also is expected to mobilize metals following treatment through the bio-barriers; therefore, there would be a potential impact to the environmental based on this effect. G-4 could also produce treatment residuals by incomplete oxidation. Finally, G-4 would destroy existing microbial populations in the treatment zone that are currently metabolizing CVOCs. Please edit the discussion accordingly.*

Response: The table will be revised to note the potential mobilization of manganese and iron and potential for incomplete oxidation. The temporary impact on the microbial population will also be noted.

52. *Figures 1-2 and 1-3 - Figure 1-3 shows a floor drain lines leading northward from the former B81 to the sanitary sewer line beyond the building footprint. The figure also shows another floor drain near the southwestern corner of the building footprint leading southward to the storm drain system. Unfortunately, it is not clear how these drains connect with the overall utility network, as neither connection is shown on Figure 1-2, which places the former building in relation to the surrounding buildings and the subsurface utilities. Is the "drain line" shown to the north of B81 on Figure 1-2 the sanitary sewer, or a storm drain? Also, EPA notes that the storm sewer alignment shown between B81 and B140 does not appear to be accurate. Site walkovers strongly suggest the presence of a larger E-W storm drain system beneath the paved area between buildings 81 and 140.*

    Additional detail is needed in advance of remediation towards preparing an accurate depiction of the lateral and vertical position of all existing subsurface utilities at Building 81. There are no utility lines depicted south and east of Building 81. Please either clarify that none exist in these locations or that the presence of utilities in these areas is unknown. If present, utility lines could provide a preferred pathway for soil gas.

Response: As noted in the Response to Comment No. 14, all the figures in Section 1 of the FS are from the RI and are included in the FS to support the site background information presented in Section 1. As discussed in the Responses to Comment Nos. 3 and 4, the Navy plans to further research the subsurface utilities and use the information in the remedial design. While Figures 1-2 and 1-3 will not be changed in the FS, the following additional information is provided:

- The floor drain in the Assembly Hall (Figure 1-3) leads to the kitchen. According to plot plans, wastewater from the kitchen discharged from the former building via a 6-inch sanitary sewer line oriented east-west that connects to a 10-inch sanitary sewer line oriented north-south on the west side of Shea Memorial Drive. The 6-inch pipeline is depicted on Figure 1-2 between the "M" and "E" in Memorial.
- The floor drain in the Service Room leads to a 4-inch clay pipe (storm drain) oriented north-south that discharges into a catch basin located between the Building 81 footprint and Building 140. A 10-inch storm drain extends east-west from the aforementioned catch basin and connects to the 24-inch storm drain oriented north-south on the west side of Shea Memorial Drive.
- The drain line to the north of Building 81 is a 10-inch storm drain that is oriented east-west and connects to the 24-inch storm drain oriented north-south on the west side of Shea Memorial Drive.
- The utility lines depicted along Shea Memorial Drive extend the length of the street.
- There are no known subsurface utility lines between the east side of the former Building 81 footprint and the fence.
- A field check of the various utility lines will be performed as part of the remedial design. The Navy will continue to search for as-built utility maps for use in the remedial design.

53. *Figure 1-4 - Please indicate in this figure what the designation "SW" in the label B81-SW-XX or*

B81-MWXX-SW-XX refers to.

Response: "SW" refers to subsurface soil samples that were collected from the sidewalls during the 1998 Release Abatement Measure excavations. Additional information is presented in Table 2-1 of the RI.

54. Figure 1-8 - Please review and correct the legend symbol for the well tags; the elevation data in red letters should apparently be bedrock surface elevation rather than groundwater elevation.

Response: As noted in prior responses, the figures in Section 1 of the FS are from the RI and are included in the FS to support the site background information presented in Section 1. However, since the Figure 1-8 legend is incorrect, it will be changed from "Measured Groundwater Elevation" to "Bedrock Surface Elevation."

55. Figure 1-10 - Figure 1-10 presents deep overburden ground water contours from data collected on February 9, 2010. This map is revealing in that it shows an unusual low in the contoured head field near MW-47I, which has the attributes of a drain-like feature. This is perhaps to be expected given the proximity of this point to the N-S oriented storm sewer alignment located on the west side of Shea Memorial Drive. Further work is needed in regards to more accurately resolving the influence of underground utilities on ground water flow and contaminant transport. Please see also general comments 3 and 4, above, underground utilities and extent of plume (overburden).

Response: Comment acknowledged. Please also see the Responses to Comments 3 and 4 above. Any additional work will be performed in support of the remedial design.

56. Figures 1-13 to 1-16 - Please correct the note in each of these figures that refers to the Region 9 PRG for PCE as 0.1 µg/L. The current Regional Screening Level (RSL) for PCE in tapwater is 0.072 µg/L. Please correct.

Response: As noted in prior responses, all the figures in Section 1 of the FS are from the RI and are included in the FS to support the site background information presented in Section 1. Since the note on the four figures references the Region 9 PRG which was used in the RI, the note will not be changed.

57. Figure 1-14 - There are at least two ways to interpret this figure regarding the presence of PCE in deep overburden. Either the source of PCE in the deep overburden has been depleted and the plume has migrated downgradient from the source area, as depicted here by Navy, or the lack of deep overburden wells between I-12 and I-19 has masked the fact that the source is located upgradient of location I-12 in which case Navy's proposal to treat the deep overburden in the vicinity of I-12 may be under-designed due to greater source area concentrations and provide inadequate source control.

Response: The Navy removed the source of contamination in 1991 and much of the area east of I-12 was excavated in 1998 to 10 feet bgs. Based on available information, the PCE plume has migrated downgradient from the source area. However, it is not known if PCE levels between I-12 and I-19 have been completely depleted. Pre-design sampling could be used to confirm the extent of the contamination in the source area. Sampling existing injection well I-20 would help in this regard as this well was not sampled as part of the RI. I-20 is located between I-12 and I-19 and is screened in the deep overburden (14-17 ft. bgs). The target treatment zones shown on Figures 4-3 and 4-4 are based on concentration contours that were developed during the RI. Additional injection points may be considered during the remedial design phase based on additional groundwater sampling results.

58. Figures 1-15 and 1-16 - The "boxes" depicting the proposed injection regions for deep and shallow bedrock for EOS and/or oxidants does not account for southward-projecting lobes of contamination in both the shallow and deep bedrock. Figure 1-15 clearly shows a "tongue" of high concentration material in bedrock leading from BR-07 to BR-13 andBR-21. Similarly, deep bedrock contamination (Figure 1-16) shows a south-projecting plume lobe from MW-03D to MW-35D. Additional efforts *should be made to understand the orientation and inter-connectivity of the fractures which connect these regions of bedrock in a north-to-south manner before the additional expense and effort is directed towards inducing fractures in the subsurface. Perhaps there is a more elegant and inexpensive means of delivering oxidants to the affected regions of deep and shallow bedrock which exploits the density of permanganate solutions? For example, it may be possible to deliver permanganate solutions to the top-of-bedrock surface beneath the former tank area. Geophysical monitoring such as described in General Comment 9, above, (Deliverability Issues/Injection Performance Monitoring) could provide a means of assessing whether such an approach could yield successful delivery of oxidants to the appropriate regions of the subsurface.*

Response: The treatment zones are based on the observed levels of contamination and the understanding of the groundwater system. The treatment zone assumes that the source is defined by the 1,000 µg/L contour. Since the elevated concentrations in BR-13 and BR-21 are less than the selected value, the area was not included for treatment.

Distribution of any injected material is difficult. An alternative approach could be considered in the design phase, but there is nothing to suggest that the suggested method is likely to be any more successful than injection.

59. *Figure 2-1 - Review of Figures 1-15 and 1-16 suggests that the LUC boundaries presented in Figure 2-1 may not be adequate because the PCE plume appears to be migrating to the south toward the Mixed-Use Village District in both the shallow and deep bedrock at concentrations that may potentially exceed the cleanup goals. Less significantly, based on available data, the deep bedrock plume is also migrating to the northwest toward the VCD. These areas need to be monitored for continued migration and possibly treatment if the concentrations continue to increase.*

Response: Figure 2-1 represents the estimated extent of groundwater contamination, not LUC boundaries. The permanent LUC boundary shown on Figure 4-2 is however based on the known extent of groundwater contamination as identified during the RI and shown on Figure 2-1. The Navy anticipates installation of additional wells in support of the remedial design and will develop a comprehensive long-term monitoring strategy that will incorporate monitoring these areas to assess continued migration of contaminants. The LUC boundaries established in the LUC RD will take into account any additional groundwater sampling data.

60. *Figure 4-2 – As discussed in Comment 32., above, the LUC boundaries presented in this figure may need to be expanded. Final LUC boundaries will be established in the LUC RD and justification will be required for the boundaries, including the basis for locating the boundaries. The boundaries will also need to protect the remedy from interference from any wells that could impact the groundwater flow at the site.*

Response: As noted in the comment, the LUC RD will include details on the LUCs, their implementation, and LUC boundaries.

61. *Figure 4-3 - The bioremediation treatment area should encompass locations where DNAPL is suspected; therefore, the local bedrock topography should be considered and the area around the former tank should probably be included within the treatment area.*

Response: The treatment area is based on the observed PCE concentrations. There are no significant PCE concentrations in the deep overburden. The bedrock topography suggests a gradual slope downward to the west and southwest, but no low point where DNAPL might collect. The shallow bedrock treatment zone is beneath part of the footprint of the previous excavation.

62. *Figures 4-3 and 4-4 - The "boxes" depicting the proposed injection regions for deep and shallow bedrock for EOS and/or oxidants does not account for southward-projecting lobes of contamination in both the shallow and deep bedrock. Additional efforts should be made to understand the orientation and inter-connectivity of the fractures which connect these regions of bedrock in a north-to-south*

manner before the additional expense and effort is directed towards inducing fractures in the subsurface. Perhaps there is a more elegant and inexpensive means of delivering oxidants to the affected regions of deep and shallow bedrock which exploits the density of permanganate solutions? For example, it may be possible to deliver permanganate solutions to the top-of-bedrock surface beneath the former tank area. Geophysical monitoring such as described in General Comment 8, above, (Deliverability Issues/Injection Performance Monitoring) could provide a means of assessing whether such an approach could yield successful delivery of oxidants to the appropriate regions of the subsurface.

Response: Please see the Response to Comment No. 58.

63. *Appendix B - Several changes in toxicity values are needed to update the chemical properties look up tables for the calculation of risk-based groundwater concentrations using the Johnson and Ettinger software. For PCE the inhalation unit risk (IUR) should be changed from 5.9E-06 per ug/m^3 to 2.6E-07 per ug/m^3. For PCE the inhalation reference concentration (iRfC) should be changed from 2.7E-01 to 4E-02 mg/m^3. For naphthalene, the IUR should be changed from 3.4E-05 per ug/m^3 to 0.0E+00 ug/m^3 because the IRIS database indicates that the carcinogenic potential for inhalation cannot be determined. Review of the calculations for the construction worker on the last 3 pages of Appendix B indicates that these changes should also be made in the table on page 2 of 3. Please revise the PRGs based on these changes and provide updated documentation.*

Response: The PRGs for PCE for all receptors will be updated to include the current toxicity criteria for PCE. Updated files will be included in Appendix B, and the updated Table 2-3 will reflect these changes. However, for naphthalene, the IUR will not be revised from 3.4E-05 ug/m^3 to 0 ug/m^3. This change will not be made because the IRIS database cancer classification referred to in the comment was based on a study performed in 1992, whereas the IUR of 3.4E-05 ug/m^3 is a California Environmental Protection Agency (Cal EPA) value based on a study performed in 2002 and is therefore based on more recent information. Also, because the cancer risks estimated in the human health risk assessment (HHRA) were based on this Cal EPA IUR, the PRGs should be based on the same toxicity criteria.

64. *Appendix B – In the table of PRGs for the Recreational Users please use the latest RSLs (November 2011) rather than the June 2011 RSLs cited in table note #1.*

Response: The PRG summary tables presented in Appendix B will be revised to present the most recent RSLs (May 2012).

65. *Appendix C - All of the calculations in this table have used an organic carbon fraction of 0.002; however, the Biochlor modeling was performed assuming an organic carbon fraction of 0.001. Please correct as appropriate for consistency.*

Response: The Biochlor modeling will be revised using an organic carbon fraction of 0.002 to be consistent with Appendix C.

66. *Appendix C - The calculations used the effective porosity of 0.20 for the overburden calculations however it appears that the total porosity of 0.32 (see the Appendix D calculations) should have been used.*

Response: The overburden calculations in Appendix C will be revised to use the total porosity of 0.32 to be consistent with Appendix D calculations.

67. *Appendix C - EPA was unable to reproduce the pounds of contaminant sorbed to soil for all the bedrock calculations. The Navy's values are larger by a factor of three. Please clarify how these values were calculated. The values for the overburden could be replicated.*

Response: The calculations will be checked and revised as appropriate.

68. Appendix D, Correspondence from Geo-Cleanse International to Wang, Li - The technical approach and basis for the recommended "fracturing" in deep and shallow bedrock needs to be supplied. Is the fracturing to be done by Geo-Cleanse International or another vendor? Appropriate qualifications and case-studies need to be provided. The correspondence refers to the vendor's experience in determining appropriate fracturing and associated "blend volumes". This information needs to be supplied for regulatory review. The correspondence also fails to list performance monitoring as an element of the proposed work. This is not acceptable. Given past experience at this site, with this vendor, EPA will insist on approving a performance monitoring plan including all direct and indirect monitoring to be conducted during, before and after any injections. In addition to the suggestions made in the forgoing comments, a number of additional "lessons learned" from the previous ISCO pilot test at B81 can be reviewed in the following paper: Brandon, W.C., Whittemore, P., McTigue, D., and Chaffin, D., 2002, Regulatory Perspective: In-Situ Chemical Oxidation Pilot Test in Fractured Granite, Proceedings of the 3rd International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Battelle, Monterrey, California, May, 2002.

Response: Additional supporting information on the technical basis of hydrofracture emplacement of potassium permanganate solid blend in the bedrock as well as the vendor's qualifications and case-studies will be provided. Note that should Alternative G-4 be selected, the remedial design will provide the details indicated in the comment. Also note that Geo-Cleanse was contacted for information to support estimating the costs of the alternative for the FS only. Vendors will be selected during the remedial design phase.

Performance monitoring is included in the preliminary design of Appendix D, although this information was not provided by the vendor contacted for cost information. However, details of the injection system and the performance monitoring plan will be refined during the remedial design phase based on all available supporting information. The referenced "lessons learned" paper will be reviewed as appropriate.

69. Appendix D - Page 1 of 33: The calculation for the barrier residence time was performed assuming a PCE PRG of 5 µg/L when in fact it appears that the treatment goal for PCE should be 11 µg/L (see Table 2-3) if the daughter products are neglected. However, because the PRG for vinyl chloride is 2.6 µg/L and one mole of PCE can generate 0.48 moles of vinyl chloride then 5.4 µg/L of PCE leaving the bio-barrier could generate 2.6 µg/L of vinyl chloride downgradient. Therefore, the use of a 5 µg/L treatment goal for PCE through the bio-barriers may be more appropriate in consideration of the daughter products and the resistance of vinyl chloride to reductive dechlorination. Please edit the calculations to provide the rationale used to establish the 5 µg/L treatment goal.

On the other hand if treatment through the bio-barrier primarily facilitates the conversion of PCE to TCE based on the residence time within the bio-barrier, with little impact on the daughter products, then the concentration of TCE produced in the bio-barrier and its daughter products generated downgradient of the bio-barrier will potentially be problematic. Navy needs to supplement this FS to demonstrate that the daughter products of PCE generated in the bio-barrier will not create excess risk downgradient.

Response: The 5 µg/L value was used as a target for treatment to provide a safety factor to address uncertainties. Degradation of all COCs is continuous. As PCE is degraded, the daughter products will then begin to be converted. The selected barrier width in the conceptual design was also larger than theoretically calculated to ensure degradation of PCE and its daughter products to safe levels inside the barrier and within a short distance from the barrier.

70. Appendix D – Page 6 of 33: The calculations for shallow bedrock assume that groundwater containing only 10 µg/L of PCE will enter the bio-barrier, essentially assuming that the plume is static. It is likely that this grossly underestimates the required capacity of the bio-barrier because well MW-21D, located immediately upgradient of the proposed bio-barrier had PCE concentrations of 270 µg/L in 2006 and 57 µg/L in 2009 and the 100 µg/L PCE concentration contour is only 25 feet upgradient of the proposed bio-barrier. However, the design uses a minimum bio-barrier width of 10 feet based *on the radius of influence of the injection wells rather than the calculated four-foot width; therefore, the design capacity would accommodate a 100 µg/L influent PCE concentration without any safety factor.*

Response: Comment noted.

71. <u>Appendix D</u> *- Pg. 8 of 33: It is not apparent that the total porosity for the shallow bedrock should be equal to the effective porosity. This could potentially result in a significant difference for the mass of treatment chemical required. The same comment applies to the deep bedrock. Please provide the data/documentation in support of this assumption.*

Response: Bedrock porosity was not measured in the RI; therefore literature values were used in the preliminary design calculation. Even though the same value was used for total porosity and effective porosity, the safety factor used to estimate the electron donor demand would compensate for any extra contaminant mass in low permeability zones or dead volumes of the bedrock.

72. <u>Appendix D</u> *- Pg. 9 of 33: The calculations for shallow bedrock for the mass of treatment chemical required are based on groundwater containing only 57 µg/L of PCE which could potentially grossly underestimate the mass of treatment chemical required. For example well MW-21D, located immediately upgradient of the proposed bio-barrier had a PCE concentration of 270 µg/L in 2006 (57 µg/L in 2009) and the 100 µg/L PCE concentration contour is only 25 feet upgradient of the proposed bio-barrier. The calculation for the mass of treatment chemical required uses a safety factor of five, presumably to account for unknown chemical demand from non-target compounds, but which could also provide some safety for CVOC concentrations in excess of the design values. However, EPA notes that the use of 57 µg/L of PCE in these calculations (the 2009 value) is not consistent with the deep bedrock calculations for the mass of chemical required wherein the deep bedrock calculations used the greater 2006 PCE concentration of 220 µg/L rather than the lesser 2009 value of 80 µg/L. EPA does not believe that Navy should use the lower PCE concentration and then rely on the safety factor to treat the greater PCE concentrations likely to occur.*

Response: The calculations for the deep bedrock barrier wells will be revised to use the 2009 value of contaminant concentrations to be consistent with shallow bedrock calculations. However, the detailed design of the barrier wells and electron donor demand will be performed during the Remedial Design phase with further supporting information from baseline sampling and pilot studies if this remedy is selected.

73. <u>Appendix D</u> *- Pg. 11 of 33: The calculations for deep bedrock assume that groundwater containing only 10 µg/L of PCE will enter the bio-barrier, essentially assuming that the plume is static. It is likely that this grossly underestimates the required capacity of the bio-barrier because well MW-21D2, located immediately upgradient of the proposed bio-barriers had PCE concentrations of 220 µg/L in 2006 and 80 µg/L in 2009. However, the design uses a minimum bio-barrier width of 10 feet based on the radius of influence of the injection wells rather that the calculated 0.5-foot width; therefore, the actual design capacity would greatly exceed the required capacity for even a 100 µg/L influent PCE concentration.*

Response: Comment noted.

74. <u>Appendix D</u> *- Pg. 16 of 33: There is an inconsistency between the treatment goal for the Target Treatment Zone as expressed here (PCE < 5 µg/L) versus the goal used for the Biochlor modeling, which was 90% reduction in concentration. This same comment applies to the calculations for all three treatment intervals. Please resolve the discrepancy.*

Response: The lower treatment goal and other safety factors used in the preliminary design calculation are to provide for the maximum degradation of contaminants which can be achieved by a sufficient quantity of electron donor. The 90% source removal and secondary injection assumed in the Biochlor modeling was to address any further uncertainties with the treatment.

75. *Appendix D - Pg. 17 of 33: A residence time requirement was calculated but this value was not apparently used to design the configuration of the treatment zone unless Navy omitted showing that calculation. Based on the calculated residence time requirement of 32 days and a seepage velocity of 0.6 feet per day, the effective treatment length should be 20 feet. The proposed treatment zone is only 20 feet x 20 feet; therefore, the upgradient end of the treatment zone would need to be located at the exact location of the maximum PCE concentration and oriented along the groundwater flow path. Because Navy does not know where the maximum PCE concentration is located based on the limited available data (280 µg/L was used for the calculations), the proposed treatment zone cannot be considered adequate. A more conservative design using a safety factor is warranted to ensure that the source area is adequately treated*

Response: The actual residence time based on seepage velocity will be added to the calculation for comparison. Please note this alternative was developed to address the high concentration source area to achieve a certain degree of source removal and then allow any remaining contamination within the treatment zone and the rest of the plume to slowly degrade by natural attenuation. The biobarriers will intercept and treat any remaining contamination in the plume. Therefore, it is not necessary to increase the source area treatment zone size to meet the RAOs.

76. *Appendix D - Pg. 20 of 33: Navy has assumed that a PCE concentration of only 1.5 µg/L will pass through the treatment zone over the year following the initial treatment. This assumes that no DNAPL exists in the deep overburden and does not apparently account for the mass of PCE adsorbed to the soil that would solubilize over time. Please explain the basis for the 1.5 µg/L concentration and why this design is considered adequate*

Response: The low concentrations of PCE in the deep overburden do not suggest the presence of DNAPL. Based on available groundwater data, concentrations of PCE exceeded 1 percent pure phase solubility at only two locations – BR-07 and MW-3D, both are bedrock wells. The upgradient concentrations that will flow into the treatment zone are based on the maximum detected concentration at upgradient wells in deep overburden, i.e. the concentration in well I-15 measured in 2006. Because of the low concentrations in the deep overburden, low upgradient concentrations would be expected. In addition, any mass potentially adsorbed by the soil matrix in upgradient locations is not expected to result in a contaminant concentration higher than the maximum detected concentration used in the calculation because this maximum detected concentration represents the upper limit of contaminant mass that could be released from adsorbed phase due to mixing with clean groundwater from further upgradient.

77. *Appendix D - Pg. 24 of 33: Navy has assumed that a PCE concentration of 15 µg/L will pass through in the treatment zone over the year following the initial treatment. This assumes that no DNAPL exists in the shallow bedrock and does not apparently account for any adsorbed mass of PCE that would solubilize over time. Please explain the basis for the 15 µg/L concentration and why this design is considered adequate*

Response: It is assumed that the treatment zone is located to encompass the single shallow bedrock DNAPL concentration. The shallow bedrock concentration contours do not suggest a larger area. The upgradient concentrations that will flow into the treatment zone are based on the maximum detected concentration at upgradient wells in shallow bedrock, i.e. the concentration in well BR-08 measured in 2006. In addition, any mass potentially adsorbed by the rock matrix in upgradient locations is not expected to result in a contaminant concentration higher than the maximum detected concentration used in the calculation because this maximum detected concentration represents the upper limit of contaminant mass that could be released from adsorbed phase due to mixing with clean groundwater from further upgradient.

78. *Appendix D - Pg. 29 of 33: Navy has assumed that no residual PCE will remain in the treatment zone over the year following the initial treatment. This assumes that no DNAPL exists in the deep bedrock, that the contaminated area in bedrock is adequately defined and treated, and that no adsorbed mass of PCE exists to solubilize over time. Please explain the basis for these assumptions and why this*

design is considered adequate

Response: It is assumed that the treatment zone encompasses the source area with the single deep bedrock DNAPL concentration. The concentration contours do not suggest a larger area. The upgradient concentrations that will flow into the treatment zone are based on the average of the upgradient contours. Based on available data, the Navy believes that the treatment zone has been properly defined to cover the highest concentration area where any potential source may exist. The safety factors in the preliminary designs, e.g. larger treatment area and extra amount of electron donors or chemical oxidant, were used to account for any potential source mass that is either in NAPL phase or adsorbed phase in the treatment zone. The secondary treatment addresses uncertainties about any residual source mass that may persist and cause rebound in source concentrations. In addition, the goal of source zone treatment is to reduce source concentrations to the maximum extent practicable, not to completely clean the target treatment zones. Any remaining contamination in the treatment zone and the rest of the plume will be slowly degraded by natural attenuation. The biobarriers will act as a barrier to intercept any residual contamination at the plume edge to prevent any off-site migration. Therefore, the preliminary conceptual design presented in the FS is considered adequate.

79. *Appendix D - Pg. 30 of 33: Under Replenishment, the text states this would occur once after five years; however, the text in Section 4.2.3.1 on page 61 states that replenishment would occur after 3 years. The cost estimate is based on 5 years. Please review and correct as appropriate*

Response: The text in Section 4.2.3.1 will be corrected to 5 years as suggested in the comment to be consistent with the assumptions used in the design calculation and the cost estimate.

80. *Appendix D - Pg. 32 of 33: The three lines above the first table on this page should apparently be deleted as they appear to have been superseded by the table. Please review and correct.*

Response: Appendix D will be edited as suggested.

81. *Appendix D - Pg. 32 of 33: Regarding Post Injection Monitoring, it is not apparent how the proposed number of samples would be adequate considering that nine fractures are planned for the shallow bedrock and six fractures are planned for the deep bedrock. Please clarify and explain what the scope of this sampling will be.*

Response: The monitored intervals of the bedrock monitoring wells intercept multiple fractures. It is expected that existing monitoring wells can be used for monitoring. The number of monitoring wells was selected for the purposes of the cost estimate, and the actual number of wells will be determined during the remedial design phase.

82. *Appendix E - Page 2 - The paragraph at the top of the page refers to Building 91; presumably the reference should be to Building 81. Please confirm*

Response: The text will be corrected as suggested.

83. *Appendix E - Page 2 - The second paragraph on the page indicates that the source decay rate was estimated by calibrating the model and the result was a "conservative" decay rate. There is no basis with the data available for estimating a source decay rate and in fact the PCE concentrations measured at the "source" well, BR-07, have increased from 4,300 µg/L in 2006 to 11,000 µg/L in 2009. This suggests that the source is farther upgradient and that the source concentration is greater than 11,000 µg/L.*

Response: The Shallow Bedrock model will be re-calibrated to the BR-07 data from 2009. An upgradient well, BR-08, is located approximately 20 ft from BR-07 but BR-08 had a significantly lower PCE concentration. Therefore, BR-07 is believed to be located in a limited high concentration area and is representative of any potential source in that area. Please note that because the simulations performed were based on the limited available site data and the tool used for the simulations has certain limitations that could not capture all the site-specific features at a complex site like Building 81, the cleanup time estimates presented in the FS can and are used for a comparison between different remedies.

84. *<u>Appendix E</u> - Page 3 - The discussion under Model Predictions indicates that the times to achieve cleanup with treatment are based on 90% source reduction for Alternative G-3 and 70% source reduction for Alternative G-4; however, there is no basis provided for these assumed treatment results. Please provide it, citing any case history if available. These assumptions have an inherent bias toward Alternative G-3 without the rationale to support the assumptions.*

<u>Response:</u> The assumed source removal efficiencies were based on a literature search of typical values, e.g. *Adamson, D. T., McGuire, T. M., Newell, C. J., and Stroo, H. (2011) Sustained treatment: Implications for treatment timescales associated with source‐depletion technologies. Remediation Journal, 21(2), 27–50; ITRC (2011) Integrated DNAPL Site Strategy; McGuire, T. M., McDade, J. M., and Newell, C. J. (2006) Performance of DNAPL Source Depletion Technologies at 59 Chlorinated Solvent‐Impacted Sites. Ground Water Monitoring & Remediation, 26(1), 73–84.* The lower source removal efficiency for ISCO was assumed to account for potential rebound of contaminant concentrations that typically occurs after ISCO treatment.

85. *<u>Appendix E</u> - The fact that the model calibration for Deep Overburden underestimates the concentrations of the daughter products at the assumed source well, I-12, suggests that I-12 is not the source well and that the real source well is upgradient of I-12. How would Navy explain the significant daughter product concentrations in the presence of a significant known PCE concentration?*

<u>Response:</u> The Deep Overburden model will be recalibrated to better match the daughter products at I-12. However, please note that because the simulations performed here were based on the limited available site data and the tool used for the simulations has a number of limitations that could not capture all the site-specific features at a complex site like Building 81, the cleanup time estimates presented in the FS can and are used for a comparison between different remedies.

86. *<u>Appendix E</u> - For the Deep Overburden Run 1 (G-2) data entry page the simulation time is shown as 50 years; however, the output is actually based on an input value of 35 years so it appears Navy must have copied the wrong input page. This should be corrected or if correct, it should be explained.*

<u>Response:</u> The simulation was run for 50 years, but the time for all contaminants to reach levels below the PRGs is 35 years. Therefore, the simulation results of Year 35 were presented.

87. *<u>Appendix E</u> - Shallow Bedrock Calibration: Navy has estimated times to cleanup using the 2006 data; however, the significantly greater PCE concentration measured at BR-07 in 2009 as compared to 2006 was not properly accounted for in the model calibration so the results for all the Shallow Bedrock modeling runs have no credibility. Because the 11,000 µg/L PCE concentration existed in 2009, it or an even greater upgradient concentration must have existed in 2006. The model calibration did not account for that and neither did the modeling for the Shallow Bedrock.*

<u>Response:</u> Because the wells assumed to be along the flow centerline downgradient of BR-07 were not sampled in 2009, the 2006 data for these wells and BR-07 were used for calibration for consistency. To account for the increase of PCE concentration in BR-07 in 2009 as pointed in the comment, the Biochlor model will be re-run using the BR-07 2009 data for calibration and estimation of cleanup time, assuming the contaminant concentration of downgradient wells used in the model remains the same as 2006.

88. *<u>Appendix E</u> - It appears that additional Biochlor modeling is also warranted to evaluate the change in daughter product concentrations between the bio-barrier and downgradient receptor points because daughter products will be generated at potentially significant concentrations as PCE passes through the bio-barrier. The retention time in the proposed bio-barrier is not apparently sufficient to significantly reduce the daughter product concentrations within the bio-barrier. Navy should provide additional supporting documentation to address this issue.*

Response: Additional Biochlor modeling will be performed to estimate the contaminant concentrations downgradient of the bio-barrier based on meeting 5 µg/L PCE through the bio-barrier.

89. Appendix G - Navy will need to conduct several more monitoring events and conduct additional investigation in the source area prior to completing a remedial design for this site. Some of this work will be outside the scope of the FS costing; however, some may be completed as part of a pre-design investigation and should therefore be included in the cost estimates.

Response: As noted in the Response to General Comment No. 2, both the Navy and EPA agreed that the site characterization was sufficient to support a Feasibility Study, with the understanding that the current monitoring network will need to be augmented and a comprehensive long-term monitoring strategy will need to be developed. The Navy anticipates that additional permanent wells will be installed and groundwater data collected to establish current conditions in support of the remedial design and long-term monitoring program. The Navy is not planning to supplement the chemical database for this site during the FS. The FS is intended to provide a conceptual description of remedial alternatives.

A pre-design investigation will be conducted to further delineate the plume extent during the Remedial Design phase. The cost estimates developed for Alternatives G-2 through G-4 include a pilot test for the biobarriers, which covers a groundwater monitoring event for determination of the optimal location of the biobarriers.

NAVY RESPONSES TO MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (MASSDEP) COMMENTS DATED MAY 23, 2012
DRAFT FEASIBILITY STUDY – BUILIDING 81
FORMER NAVAL AIR STATION (NAS) SOUTH WEYMOUTH, MASSACHUSETTS

The Navy's responses to the MassDEP comments on the Building 81 Draft Feasibility Study (dated April 2012) are presented below. The MassDEP's comments are presented first (in italics) followed by the Navy's responses.

<u>Comment 1, Section 2.0:</u> *The absence of medium and high yield aquifers does not justify the conclusion that use of site groundwater for drinking water purposes is not reasonably foreseeable. Further, though cleanup for potable use and irrigation use is not required, these pathways pose unacceptable risk and therefore must be addressed in the FS, for example using an LUC to prevent such exposures. Accordingly, the second paragraph should be revised to indicate that site groundwater need not be cleaned-up to allow drinking or irrigation uses based on the MassDEP groundwater classification (GW-3), the base Reuse Plan, and the site-specific redevelopment plans of the South Shore Tri-Town Development Corporation.*

<u>Response:</u> The paragraph referenced in the comment will be revised as follows: "As shown on Figure 2-1, the Site is located in a portion of the Base where MassGIS has not mapped any medium- or high-yield aquifers. MassDEP has assigned category GW-3 to groundwater at the Site. GW-3 category groundwater does not need to be cleaned-up to allow for drinking water or irrigation uses. In addition, the Local Redevelopment Authority, South Shore Tri-Town Development Corporation (SSTTDC), as well as the Master Developer, LNR South Shore LLC (LNR), have indicated that production, supply, or irrigation water needs for the redevelopment can be provided by sources other than the groundwater under the Building 81 Site. Potential exposures to groundwater used for production, supply, or irrigation will be prevented through implementation of land use controls as described in Section 4."

<u>Comment 2, Section 2.1:</u> *The results from the remedial investigation indicate that the media of concern include groundwater, soil (below 6 feet), and soil gas (i.e., vapor migration from groundwater). All of these media must be addressed in the FS, though not necessarily by medium-specific remedial action. For example, vapor can be addressed indirectly by remediating groundwater. Similarly, soil can be addressed indirectly by treating groundwater in the source area.*

<u>Response:</u> Agreed. The first sentence of Section 2.1 will be revised as follows: "…the media of concern at the Site were determined to be groundwater and vapors migrating from groundwater." The following sentence will be added to the end of Section 2.1: "Contaminants in saturated soils at a depth of 6 to 20 feet will be indirectly addressed in the FS by the groundwater treatment alternatives."

<u>Comment 3, Section 2.4.1 and Table 2-3:</u> *Appendix B indicates that the "recreational" indoor air scenario used to calculate PRGs for vapor intrusion is less conservative (e.g., 39 days per year exposure) than the typical scenarios used to assess vapor intrusion risk on non-residential property (e.g., commercial exposure scenarios). To justify using this less conservative approach, the report should document the reasons why the uses allowed by the base reuse plan and site-specific redevelopment plans of the SSTTDC would not include the typical non-residential indoor air exposure scenarios. Also, Appendix B should include supporting calculations for all the PRGs presented in Table 2-3.*

<u>Response:</u> The allowable uses for the RecD zone stated in the SSTTDC Zoning and Land Use By-Laws include indoor commercial recreational uses and health/fitness clubs; no residential, other commercial or industrial uses are allowed in the RecD zone. PRGs will be developed for recreational exposure via vapor intrusion using a commercial/industrial scenario to address these allowable uses. The supporting calculations for the PRG calculation for vapor intrusion in a residential scenario were missing in the draft FS and will be included in the next version.

<u>Comment 4, Section 2.4.2 and Tables 2-1, 4-2, 4-5, and 4-8:</u> *The characterization of GW-3 standards as "…protective of public health, public welfare, and the environment (i.e., represent a condition "no* *significant risk"), given the exposures assumed…" should be deleted. While it is acceptable to present the GW-3 standards as maximum values for PRG selection purposes, it is inappropriate to draw conclusions concerning risks to human health and the environment because site risks were not assessed in accordance with a Method 1 assessment under the MCP. Further, deletion of this language will eliminate the need to explain why the GW-2 standards were not also identified as TBCs.*

Response: Agreed. The second paragraph of Section 2.4.1.2 will be revised as follows: "MassDEP GW-3 standards, which are applied to all groundwater, were selected as TBCs and used as maximum values for PRGs. Where…" In addition, the first sentence in the 'synopsis' column for the referenced TBC ARAR will be deleted in Tables 2-1, 4-2, 4-5, and 4-8. GW-2 criteria were not considered because site-specific vapor intrusion PRGs were calculated.

Comment 5, Section 4.2.2, Alternative G-2: Bio-Barriers, MNA, and LUCs:

a. To assess metals mobilization, all monitoring samples collected from wells located downgradient of the bio-barriers should be analyzed for iron and manganese.

Response: Agreed. Analysis for iron and manganese will be added to the existing list of analytes for monitoring wells downgradient of the bio-barrier in the discussion of the MNA component of Alternative G-2.

b. The performance of the bio-barriers following replenishment may differ from prior performance; to ensure adequate monitoring, a front-loaded monitoring schedule should be triggered following each replenishment event (e.g., semi-annual monitoring for 1 year followed by four annual rounds).

Response: Comment noted. Details of the monitoring program and schedule will be determined for the selected remedy during the remedial design. The suggestions made in the comment will be considered at that time.

c. The lateral extent of the vapor plume at the Building 81 site has not been delineated and could change as redevelopment alters the surface across the site. Consequently, to prevent potentially unacceptable vapor exposure, the interim LUCs boundary should be the same as the permanent LUCs boundary, or vapor sampling should be conducted to determine the extent of the vapor plume and the monitoring program expanded to monitor vapors and ensure that unacceptable vapor exposures do not occur as redevelopment proceeds.

Response: As noted in the FS, LUC details will be determined as part of the LUC RD. However changes to the interim and permanent LUC boundaries shown in the FS would likely impact development plans. As part of the remedial design for the selected remedy, passive vapor screening and/or additional vapor sampling could be included as a pilot study activity.

Also note that unacceptable vapor concentrations would only be present in the vicinity of contamination in the shallow overburden groundwater. However, COC concentrations in the shallow overburden groundwater are very low so a vapor plume with unacceptable concentrations is unlikely to be present.

d. Because this alternative does not include a source control component or active measures to address unacceptable risks upgradient of the bio-barriers, an active remedial action contingency component should be included to provide a response that could be implemented if the results from the monitoring program indicate that unacceptable risks will not be addressed in a reasonable timeframe.

Response: The monitoring component of this alternative will be used to determine the timing for additional injection of electron donor substrate or need for contingency measures. Different types of substrates can be used based on the monitoring results. Text will be added to describe various types of contingency measures that would be considered if needed to change from reducing conditions to oxidizing conditions.

<u>Comment 6, Section 4.2.3, Alternative G-3: Enhanced In-Situ Bioremediation, Bio-Barriers, MNA, and LUCs:</u>

a. *To improve the sustainability of the target treatment zones, several additional injectors should be installed immediately upgradient of the source zones (a strong reducing zone extending downgradient into the source area could be effective even if source area contaminant concentrations are too toxic to allow microbial communities to be established where the source area concentrations are highest).*

<u>Response:</u> The target treatment zone is based on concentration contours developed during the RI. Pre-design sampling will be used to confirm the extent of the contamination in the source area. Additional injection points may be considered during the design phase.

b. *To assess metals mobilization, all monitoring samples collected from wells located downgradient of the bio-barriers should be analyzed for iron and manganese.*

<u>Response:</u> Agreed. Analysis for iron and manganese will be added to the existing list of analytes for monitoring wells downgradient of the bio-barrier in the discussion of the MNA component of Alternative G-3.

c. *The performance of the bio-barriers following replenishment may differ from prior performance; to ensure adequate monitoring, a front-loaded monitoring schedule should be triggered following each replenishment event (e.g., semi-annual monitoring for 1 year followed by four annual rounds).*

<u>Response:</u> Comment noted. Details of the monitoring program and schedule will be determined for the selected remedy during the remedial design. The suggestions made in the comment will be considered at that time.

d. *The lateral extent of the vapor plume at the Building 81 site has not been delineated and could change as redevelopment alters surfaces across the site. Consequently, to prevent potentially unacceptable vapor exposure, the interim LUCs boundary should be the same as the permanent LUCs boundary, or vapor sampling should be conducted to determine the extent of the vapor plume and the monitoring program expanded to monitor vapors and ensure that unacceptable vapor exposures do not occur as redevelopment proceeds.*

<u>Response:</u> As noted in the FS, LUC details will be determined as part of the LUC RD. However changes to the interim and permanent LUC boundaries shown in the FS would likely impact development plans. As part of the remedial design for the selected remedy, passive vapor screening and/or additional vapor sampling could be included as a pilot study activity. Please also see the Response to Comment No. 5c.

<u>Comment 7, Section 4.2.4, Alternative G-4: In-Situ Chemical Oxidation, Bio-Barriers, MNA, and LUCs:</u>

a. *To assess metals mobilization, all monitoring samples collected from wells located downgradient of the bio-barriers should be analyzed for iron and manganese.*

<u>Response:</u> Agreed. Analysis for iron and manganese will be added to the existing list of analytes for monitoring wells downgradient of the bio-barrier in the discussion of the MNA component of Alternative G-4.

b. *The performance of the bio-barriers following replenishment may differ from prior performance; to ensure adequate monitoring, a front-loaded monitoring schedule should be triggered following each replenishment event (e.g., semi-annual monitoring for 1 year followed by four annual rounds).*

Response: Comment noted. Details of the monitoring program and schedule will be determined for the selected remedy during the remedial design. The suggestions made in the comment will be considered at that time.

c. *The lateral extent of the vapor plume at the Building 81 site has not been delineated and could change as redevelopment alters surfaces across the site. Consequently, to prevent potentially unacceptable vapor exposure, the interim LUCs boundary should be the same as the permanent LUCs boundary, or vapor sampling should be conducted to determine the extent of the vapor plume and the monitoring program expanded to monitor vapors and ensure that unacceptable vapor exposures do not occur as redevelopment proceeds.*

Response: As noted in the FS, LUC details will be determined as part of the LUC RD. However changes to the interim and permanent LUC boundaries shown in the FS would likely impact development plans. As part of the remedial design for the selected remedy, passive vapor screening and/or additional vapor sampling could be included as a pilot study activity. Please also see the Response to Comment No. 5c.

d. *The results from the 2001-2002 ISCO pilot study indicate that the effectiveness of ISCO as a source control component may be limited. In addition, the recovery time of the indigenous microbial community after ISCO treatment is uncertain. Consequently, this alternative should include an additional active remedial action contingency component to provide a response that could be implemented if the results from the monitoring program indicate that unacceptable risks will not be addressed in a reasonable timeframe.*

Response: The monitoring component of this alternative will be used to determine the need for contingency measures. Text will be added to describe various types of contingency measures that would be considered should groundwater monitoring indicate that MNA is not effective.

e. *Because of relatively rapid contaminant destruction, ISCO treatments would generally be expected to provide shorter cleanup times than bio-remediation treatments. Consequently, the report should explain why the projected cleanup times for Alternative G-4 (24 years for overburden, 46 years for shallow bedrock, and 200 years for deep bedrock) are longer than the projected cleanup times for Alternative G-3 (15 years, 40 years, and 160 years, respectively).*

Response: The cleanup time estimates are based on natural attenuation of the remaining contaminants after a certain percentage of the instantaneous source removal by the selected treatment. Due to the higher degree of uncertainty in the treatment by ISCO, it was conservatively assumed that ISCO would generally achieve 70 percent source removal while bioremediation would achieve 90 percent source removal. Therefore, the projected cleanup time for ISCO is always longer than the projected cleanup time for bioremediation. In addition, because of the limitations of Biochlor, the time needed to achieve the assumed percentage of source removal could not be simulated and therefore was not accounted for in the cleanup time estimate in the draft FS. The cleanup time estimate will be revised to include an assumed time for achieving a certain percentage of source removal by the selected treatment. It will be assumed that ISCO will need 1 year to achieve 70 percent source removal, while bioremediation will need 5 years to achieve 90 percent source removal.

Comment 8, Tables 2-1, 4-2, 4-5, and 4-8: *The status of the state groundwater classification should be "relevant and appropriate", rather than "applicable" [refer to 310 CMR 40.0993(2)].*

Response: Since this ARAR was deleted from the chemical-specific ARARs tables for the SRA Site FS based on EPA's comments, the ARAR will also be deleted from the Building 81 FS tables.

Comment 9, Table 2-3:

a. *For the purpose of remedy performance evaluation, a single PRG should be selected for each site contaminant in each of the two zoning districts (essentially, the table presents an incomplete selection process). Consequently, the table should be revised to indicate that the lowest risk-based value calculated for each contaminant in each zoning district has been selected. In other words, the table should present a single column of PRGs selected for the RecD zone and a single column of PRGs selected for the VCD zone.*

Response: Selection of the lowest PRG for each zoning district would be possible only if the exposure pathways for the scenarios were comparable. For example, the residential and recreation exposure pathways are complete when a receptor is present. However, the construction worker exposure pathway is complete only when intrusive activities are being performed. These activities would be performed only occasionally, if at all, and can best be addressed through safety procedures that would be required per LUCs. Thus, the construction worker PRGs should not be used to set the site PRGs. Note that a similar presentation for selection of PRGs is used in the SRA FS.

b. *Table 2-3: The MassDEP GW-2 standard for cis-1,2-DCE (100 ug/L) could be used as a TBC to provide a risk-based concentration for vapor intrusion.*

Response: Since inhalation values are not available for cis-1,2-DCE a risk-based PRG could not be calculated. The GW-2 standard is based on protectiveness against vapor intrusion for any structure and could be used as a TBC for the residential scenario. However, the GW-2 standard would not be applicable for the industrial/commercial or recreational scenarios and the PRG will remain as 'NA.'

Comment 10, Appendix H: *MassDEP recommends a more comprehensive evaluation of the potential benefits and costs of integrating a soil excavation source remediation component into the remedial alternatives.*

As described in the Section 5.3.1.4 of the RI report, site data indicate that a substantial portion of the NAPL-solvent smear zone formed by a release(s) in the UST area extended below the UST excavation (approximately 10 feet below grade) and was not removed during the UST excavation. In addition, these data suggest that the relatively impermeable till layer underlying the UST excavation impeded further downward migration, binding residual petroleum and solvent contamination and creating a continuing source of shallow groundwater contamination. Consistent with this interpretation, the RI soil sample with the highest contaminant concentrations was collected beneath the UST excavation at 12 to 14 feet below grade, and groundwater samples collected following the ISCO pilot study indicated that dissolved-phase contaminants rebounded from this zone after ISCO treatments stopped.

These conditions are not ideal for successful implementation of the remedial technologies that were evaluated in the FS report. In particular, these conditions may explain the limited success of the 2001-2002 ISCO pilot study; tightly bound contaminants may have escaped treatment because of incomplete delivery and distribution of oxidant in a relatively impermeable zone. Similar limitations on the delivery of fluids intended to stimulate in-situ bioremediation would be expected. The presence of the UST backfill material, which could provide a preferential pathway for movement of injected fluids away from zones containing the highest contaminant concentrations, increases the uncertainty associated with these technologies. In summary, using either of these technologies at the Building 81 site would involve significant uncertainties.

A focused soil removal action component could be included in the alternatives to reduce these uncertainties, improve the reliability of the remedy, and reduce the cleanup timeframe. More specifically, if a substantial portion of the source contamination were removed by excavation, ISCO or in-situ bioremediation could then be used to perform a more reliable post-removal "polishing" step that could *complete remediation in a shorter timeframe than would be achieved by ISCO or in-situ bioremediation alone. This two-step approach would reduce the potential for remedy failure after a significant investment of time and money in either of these relatively uncertain technologies alone and reduce the potential need to implement a more aggressive and disruptive action in the vicinity of nearby redeveloped areas in the future.*

Response: The groundwater results do not suggest the presence of high concentrations of COCs in the overburden in this area. Note that Table 2-4 indicates that over 60 percent of the PCE mass (concentrations ranging from 100 µg/L to 1000 µg/L PCE) is in bedrock and thus would not be removed by soil excavation of primarily saturated overburden material. A cost estimate for soil excavation has been prepared and will be included in Appendix H. Without considering any integration of soil excavation with groundwater treatment, adding soil excavation to Alternatives G-2 to G-4 as described in the FS would increase the capital cost of each alternative by more than 65 percent.

NAVY RESPONSES TO LNR SOUTH SHORE, LLC (LNR)
COMMENTS DATED JUNE 6, 2012
DRAFT FEASIBILITY STUDY – BUILDING 81
FORMER NAVAL AIR STATION (NAS) SOUTH WEYMOUTH, MASSACHUSETTS

The Navy's responses to the LNR comments on the Building 81Draft Feasibility Study (dated April 2012) are presented below. The LNR comments are presented first (in italics) followed by the Navy's responses.

General Comment: *LNR South Shore, LLC (LNR), provides the following comments to the Draft Feasibility Study Report (FS) for the Building 81 Site, dated April 2012. By way of background, the FS was issued subsequent and pursuant to a document titled "Revised Proposed Approach for the Building 81 Feasibility Study" (Revised Approach), which was issued by the Navy on November 7, 2011. The Revised Approach incorporated the comments of the U.S. Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (MassDEP), South Shore Tri-Town Development Corporation (SSTTDC), and LNR and addressed Navy's approach to the FS based on numerous BRAC Cleanup Team (BCT) meetings and associated correspondence.*

Response: Comment noted.

Comment 1. Aggressiveness of Proposed Remedial Alternatives

The FS includes the following remedial alternatives and projected time required to achieve Preliminary Remediation Goals (PRGs):

- *G-1 – No Action*
- *G-2 – Bio-Barriers, MNA and LUCs – 35 years for overburden*
- *G-3 – Enhanced In-Situ Bioremediation, Bio-barriers, MNA and LUCs – 15 years for overburden*
- *G-4 – In-Situ Chemical Oxidation, Bio-barriers, MNA and LUCs -24 years for overburden*

The minimum estimated time to achieve PRGs (for overburden groundwater) is 15 years under remedial alternative G-2. As discussed further below, Land Use Controls (LUCs) would be implemented to control exposure to contaminants of concern (COCs) in groundwater until PRGs are achieved.

LNR believes that the timeframe to achieve PRGs under the remedial alternatives considered in the FS is too long, and that more aggressive remediation needs to be considered (either as a component of one or more of the remedial alternatives evaluated, or as an additional remedial alternative). Navy could, for example, install more injection wells over a larger portion of the plume, for either enhanced bioremediation or in-situ chemical oxidation injections. Navy could also conduct additional source removal via soil excavation, as discussed further below. More aggressive treatment would reduce the overall time required to meet PRGs for overburden groundwater, and thus reduce the amount of maintenance (O&M) required for the proposed bio-barriers and the length of time that interim LUCs are required. LNR's development timeline for the property is approximately 10 - 12 years to full build-out, pursuant to the Reuse Plan. However, even the most aggressive remedial alternative evaluated in the FS would leave the Building 81 Site virtually undevelopable for at least 15 years. Foreseeable development of the Building 81 Site under the Reuse Plan, which is centrally located within the SouthField development and in close proximity to areas currently being developed, demands a more aggressive remedial approach.

Navy should evaluate more aggressive remediation options to reduce the overall time required to achieve PRGs for overburden groundwater to less than 10 years.

Response: The FS alternatives incorporate the components included in the November 2011 Revised Proposed Approach for the Building 81 Feasibility Study. The nine CERCLA criteria used for evaluation of remedial alternatives do not focus on the time required to remediate a site. The time required for groundwater treatment, whether by anaerobic biodegradation or aerobic oxidation, is dependent on many factors, including the groundwater concentrations, rate of groundwater flow, and site geochemistry. The potential for DNAPL to be present at the Site argues against overly aggressive means which could mobilize the DNAPL. Chlorinated organic sites such as Building 81 require time for the breakdown of PCE, the main COC, to its daughter products (TCE, DCE, vinyl chloride), other less toxic compounds, and achieve the PRGs. The bio-barrier approach, which was received favorably by LNR during preparation of the Revised Proposed Approach for the Building 81 Feasibility Study, would not take up a large portion of this approximately 1-acre site. The source area treatment components are included specifically to speed up the remediation process. Increasing the size of the source area treatment zone with more injection points would add costs but not necessarily result in a significant or proportional reduction in the time frame to clean up the entire site given the time required for MNA on the balance of the plume. The alternatives presented in the FS accommodate the current re-use plan and address the CERCLA evaluation criteria (including the cost of remediation) to achieve the Navy's goal to remediate the site so that it is suitable for transfer. Please see the Response to Comment 2 regarding excavation in the source area.

Comment 2. Evaluation of Soil Excavation

Appendix H of the FS evaluates the feasibility of soil excavation in the "source area" of the Building 81 Site, and concludes that soil excavation should be eliminated from consideration as a component of the remediation due to "implementability and cost" concerns. Navy also questions the effectiveness of soil excavation. LNR disagrees with Navy's conclusions in this regard, and believes that soil excavation should be reconsidered as a component of a more aggressive remediation alternative that would reduce the time required to achieve PRGs.

Implementability is not a valid reason to rule out soil excavation. Soil excavation is readily implementable at the Building 81 Site, and Navy's conclusion to the contrary is not supported. The Building 81 Site is wide open, with no unusual barriers to excavation. Excavation is a commonly used and readily available treatment technology. Although dewatering of excavation areas may be required, necessitating treatment for site contaminants prior to discharge, this can be achieved with readily available technology. Portable, tractor trailer mounted water treatment units with granular activated carbon (GAC) could be brought to the Building 81 Site for the purpose of dewatering. Even if it was determined that shoring or sheet piling was necessary to prevent excavation areas from collapsing and/or to limit groundwater infiltration, such methods are commonplace and the contractors that perform them are readily available. Even if groundwater infiltration rates are high (which Navy states without technical justification), the limited area where soil excavation would be conducted could be excavated in a short period of time, with groundwater stored in on-site frac tanks (also readily available) and treated over a longer period. Moreover, Navy has performed excavation at the Building 81 Site in the past, and was able to do so effectively.

Navy's evaluation of the cost of soil excavation also is not well supported. Navy concludes that the cost of excavation would be "moderate to high," but does not provide actual cost estimates or other support for its conclusion. Before concluding that the cost is too high, Navy should obtain and provide viable cost estimates.

In evaluating the effectiveness of soil excavation, Navy states that "[t]he effectiveness of the excavation is limited by the contaminated groundwater that leaks back into the excavation . . . . Although excavation would remove highly contaminated saturated soil, the backfilled material would quickly be contaminated by the adjacent groundwater and so there would be no net reduction in the volume of contaminated material." This statement does not make sense. The removal of highly contaminated saturated soil would remove contaminant mass contributing to groundwater contamination, and thus should speed overall groundwater remediation and the time required to achieve PRGs. A substantial percentage of the mass of contaminants at the Building 81 Site are present in soil and therefore could be removed through soil excavation. Navy's calculations of the mass of contaminants at the Building 81 Site (Table 2-4) indicates that 96% of the on-site PCE is in the sorbed phase and that 4.16 pounds (20% of *the total mass of PCE on-site) is in overburden soil within the 100 ug/L contour line. Further, because contaminant mass would be removed with the excavated soil (and the groundwater removed and treated during dewatering) re-contamination of backfill should not be a significant concern. While Navy raises re-contamination of backfill as a reason why soil excavation would not be effective, it fails to acknowledge that the total mass of contamination at the Building 81 Site would be greatly reduced by excavation. As such, soil excavation would seem to be an effective form of remediation, and should be reconsidered in connection with a more aggressive remedial alternative.*

Navy should present a direct comparison of source removal/treatment options, such as a dollars per pound of contaminant removed and/or time required to achieve PRGs based on each source removal option. This would permit an objective comparison of the cost and effectiveness of various source area treatment technologies, including excavation.

Response: Note that Table 2-4 indicates that over 60 percent of the PCE mass (concentrations ranging from 100 µg/L to 1000 µg/L PCE) is in bedrock and thus would not be removed by soil excavation of primarily saturated overburden material. Soil excavation would not be effective in removing the PCE source in bedrock and the total mass of contamination would not be greatly reduced by excavation as suggested in the comment. If soil excavation were added to Alternatives G-2 to G-4 as described in the FS, the capital cost of each alternative would increase by more than 65 percent. A cost estimate for soil excavation will be included in Appendix H.

The concentration of PCE in the overburden in the source area is relatively low and does not suggest the presence of a significant source. Further, the 100 ug/L contour mentioned in the comment represents an area with a concentration that is below what would be considered as a source. The contour represents approximately 6,000 cubic yards of soil and approximately 210,000 gallons of groundwater (plus additional water that will continue to flow into the excavation).

Dewatering is an established construction method, but the complications from contaminated groundwater should not be dismissed. A discharge from a clean dewatering site can be readily addressed by a general discharge permit, with little, if any treatment. Where contamination is present, the water must be treated to meet discharge requirements, in this case requiring activated carbon and possibly treatment for metals removal. Groundwater that enters the excavation must be similarly treated prior to discharge.

Sheet piles are not likely to be an option because they cannot be driven and anchored into the bedrock. Thus, an excavation would be larger than the contamination footprint to accommodate the sloping of the sides of the excavation.

Comment 3. Land Use Controls (LUCs)

The FS proposes that LUCs will be implemented to prevent exposure to COCs during remediation until PRGs are achieved. As noted, the shortest estimated time to achieve PRGs for overburden groundwater is 15 years under the remedial alternatives evaluated in the FS.

The interim LUCs set forth in the FS are expected to be the same under each of the remedial alternatives evaluated. Consistent with the Revised Approach, the interim LUCs are anticipated to consist of: (1) restrictions on the type and nature of construction permitted in the "source area" of the Building 81 Site, (2) a requirement for EPA and MassDEP approval of construction dewatering plans prior to excavation activities, (3) specific health and safety procedures for construction workers, and (4) specific building design methods to mitigate potential for vapor intrusion. In addition, Alternatives G-2, G-3 and G-4 will require maintenance of injection wells at the site until the remedy is complete, limiting construction activities in the area of those wells. The interim LUCs are anticipated to be implemented in the Building 81 Site east of Shea Memorial Drive only, as COCs have not been detected in groundwater west of Shea Memorial Drive in concentrations in excess of EPA Maximum Concentration Limits (MCLs).

Figure 4-1 is referenced in the FS as the proposed boundary for the interim LUCs. The depicted area subject to the interim LUCs is much larger than previously discussed or anticipated in connection *with the Revised Approach, and suggests that the interim LUCs will be implemented over the entirety of the Building 81 Site east of Shea Memorial Drive. The Revised Approach states the following:*

> *"In all cases, the LUCs . . . analyzed in the FS will be narrowly tailored to the prevention of specific, identified risks and exposure scenarios . . . and will be limited in both location and scope so as not to unreasonably burden or prohibit reasonably foreseeable uses anticipated by the Reuse Plan."*

LNR does not believe that the interim LUCs as evaluated in the FS have been "narrowly tailored" as agreed upon in the Revised Approach. Because the remedial alternatives evaluated in the FS will take a minimum of 15 years to achieve PRGs for overburden groundwater, the Building 81 Site will be saddled with significant restrictions on what can be constructed, and how it must be constructed, for a very long time. There will be significant barriers to building anything until after the PRGs are met, which will not occur for 15 to 25 years based on the Navy's projections in the FS. From a practical point of view, the remedial alternatives considered may make it impossible to construct anything more than a parking lot at the Building 81 Site. Given the prominent location of the Building 81 Site in the context of the Reuse Plan and its importance in the overall development of the former military base, this is not acceptable to LNR. The area impacted by the interim LUCs should be reduced in size, and the LUCs should be reduced in duration, in conjunction with implementing more aggressive source removal and groundwater remediation options as discussed above. In any event, because of the burden that these interim LUCs will place on the overall implementation of the Reuse Plan, Navy should narrowly construe the area of the Building 81 Site that will be subject to the interim LUCs.

Response: At the FS stage of the CERCLA process both the alternatives and LUCs are conceptual in nature. Details for the selected alternative as well as the associated LUCs will be developed during the remedial design. Preparation of the LUC RD is part of that process as stated in the FS. LUCs are specific to the selected remedy and as such the objective to 'narrowly tailor' them during preparation of the LUC RD is appropriate for the FS.

**NAVY RESPONSES TO ADVOCATES FOR ROCKLAND, ABINGTON, WEYMOUTH, AND HINGHAM (ARAWH) COMMENTS DATED JUNE 13, 2012
DRAFT FEASIBILITY STUDY – BUILDING 81
FORMER NAVAL AIR STATION (NAS) SOUTH WEYMOUTH, MASSACHUSETTS**

The Navy's responses to the AWARH comments on the Building 81 Draft Feasibility Study (dated April 2012) received from M. Parsons on behalf of ARAWH are presented below. The comments were prepared by Cambridge Environmental Inc., ARAWH's consultant. ARAWH's comments are presented first (in italics) followed by the Navy's responses.

Comment 1. *We have reviewed the April 2012 draft Feasibility Study Report for Building 81, and we write to provide some observations and comments. Since the Feasibility Study (FS) is largely conceptual and lacking in details, many of our comments are of a general nature. However, we also offer some more specific comments on pilot testing of the selected remedial strategy to determine whether it will be a successful long-term approach.*

Response: The FS is intended to provide a conceptual description of remedial alternatives; specifics and details for the selected remedy are included at the remedial design phase.

Comment 2. *The Navy is proposing conceptually similar approaches to remediation at the Building 81 site as have been proposed for the Solvent Release Area. Chlorinated volatile organic compounds (CVOCs) in groundwater are the focus at both sites, and proposed remediation options include combinations of deed/use restrictions, bio-barriers, focused treatment at source areas, and monitoring. There are four specific options proposed in the feasibility study report:*

- *The No Action (Alternative G-1) is considered for comparative purposes, as some measure of active remediation is required to meet risk-based objectives;*

- *Alternative G-2 proposes Monitored Natural Attenuation (MNA) at the source area, installation of bio-barriers (permeable reactive barriers, or PRBs) to halt downgradient migration of CVOCs, and Land Use Controls (LUCs) to prevent unacceptable levels of exposures to CVOCs;*

- *Alternative G-3 supplements the components of Alternative G-2 with treatment of the heavily contaminated source area by bioremediation; and*

- *Alternative G-4 supplements the components of Alternative G-2 with treatment of the heavily contaminated source area by chemical oxidation.*

Response: Comment noted.

Comment 3. *Cost estimates for the four alternatives suggest a decision between spending about $3,000,000 for the G-2 Alternative or an additional $250,000 to $700,000 to implement one of the active source area treatment options. Given the opportunity to pursue at modestly higher costs a more aggressive treatment approach that might hasten the remediation effort, we feel that ARAWH should advocate for the more expensive G-3 and G-4 alternatives.*

Response: Comment noted. The Navy's preferred alternative will be presented in the Building 81 Proposed Plan after completion of the FS and discussions with EPA and MassDEP. A 30-day public comment period will be provided for the public to comment on the Proposed Plan.

Comment 4. *The discussion of Land Use Controls (LUCs) for the vapor intrusion pathway indicates that passive sub-slab vapor mitigation systems will be sufficient to protect human health (FS p. 4-12). The screening-level risk estimates for the vapor intrusion pathway indicated a risk 40 times greater than the Massachusetts target level (FS p. 1-15). Given this level of potential risk and the many factors that affect* *vapor intrusion, we recommend more stringent LUCs for future building construction that require detailed construction plan review and post-construction sampling of indoor air.*

Response: As mentioned in the Response to Comment 1, the FS provides conceptual descriptions of the components of the alternatives. The LUC component discussed in Section 4 of the FS notes that the specific controls for the Site and details of the LUCs listed in the FS would be developed during the remedial design phase. Therefore details such as those suggested in the comment will be provided as part of the remedial design.

Comment 5. *Additionally, unless bioremediation and chemical oxidation are for some reason mutually exclusive, it may be prudent for the Navy to consider both treatment options in succession, as the costs of implementing both may be reduced by synergies and overlaps in system design (e.g., it may be possible to use the same injection wells for both methods).*

Response: In the Building 81 source area ISCO followed by bioremediation could be used. However, the bioremediation treatment could not begin until all of the oxidizer has reacted. The oxidizer would increase the electron donor demand slightly, but not significantly. There does not appear to be a cost advantage in the use of both treatment options in the source area. While the same injection wells could be used, there would be a higher chemical and chemical injection cost. Note that Alternative G-4 includes bio-barriers, an anaerobic biodegradation process, and in-situ chemical oxidation.

Comment 6. *One potential concern regarding the chemical oxidation component of Alternative G-4 is whether it is likely to be effective. As described on page 1-12 of the FS report, an in situ chemical oxidation (ISCO) pilot test conducted in 2000 and 2001 failed to demonstrate reductions in peak CVOC concentrations in groundwater. Limited discussion of the previous pilot test (FS p. 3-9) suggests that peak concentrations were not reduced because the oxidant could not reach throughout the target zone, possibly because contaminants are located in bedrock fractures. Given the lack of previous success, the FS should thus discuss the changes that can be implemented to allow chemical oxidation to be successful, and hence justify its retention as a potential treatment option.*

Response: The issues noted in the comment are acknowledged in the FS. Alternative G-4 includes different oxidants than used previously in the pilot test as well as different methods to inject the oxidants. The lessons learned from the prior pilot test will be used in the remedial design, should this alternative be selected.

Comment 7. *The potential presence of the contaminant source in fractured bedrock may limit the effectiveness of both the chemical oxidation and enhanced bioremediation options. Given this uncertainty, it would be prudent to design a comprehensive pilot study to test the effectiveness of both chemical oxidation and enhanced bioremediation. The more effective treatment option could then be selected based on the results of the pilot study.*

Response: While the suggested comprehensive pilot study could provide useful information, doing so at this point in the CERCLA process would delay finalization of the FS and remedy selection by at least one year. The Navy believes that the site is adequately characterized and plans to complete the FS without further data collection. EPA agreed that the site characterization was sufficient to support a Feasibility Study, with the understanding that the current monitoring network will need to be augmented and a comprehensive long-term monitoring strategy will need to be developed. Pilot tests could be performed as part of the remedial design.

Comment 8. *Successful pilot testing depends critically on the extent of contaminated ground water within the bedrock zones. It is also critical to establish adequate monitoring points to provide effective feedback during the pilot test to assess the technology effectiveness. We have examined information in the FS document with regard to its adequacy for designing an effective pilot test, i.e., to gauge the likelihood that pilot testing will be capable of generating a successful long-term remedial approach. There are at present some data gaps that may adversely compromise this effort and should be addressed.*

- *The direction of ground water flow in the shallow and deep overburden and the shallow bedrock is to the west/southwest. This is consistent with the bedrock surface topography. A lack of bedrock ground water monitoring wells is apparent in a downgradient direction to the southeast of Building 81 along Shea Memorial Drive as observed on Figure 1-8.*

- *The base of the PCE plume as noted on Figures 1-5, 1-6 and 1-7 is inferred and is based on a single well completed in the bedrock. Additional bedrock monitoring well clusters should be installed and screened over discrete intervals to establish the base of the plume. This will assist in the applicability of the various technologies to the reduction of the bedrock plume.*

- *Figure 1-10 indicates a ground water sink and a radial flow pattern n the vicinity of MW47I in the deep overburden aquifer. This unusual flow pattern should be assessed further to assess the actual flow conditions within this permeable unit.*

- *The shape and extent of the PCE plume in the deep overburden aquifer as displayed on Figure 1-14 appears to indicate that this may be the most transmissive unit and may be the primary contaminant migration conduit for PCE.*

- *The depth to the bedrock surface and the screened interval should be displayed on Figures 1-15 and 1-16 to assist the reviewer in differentiating between the "shallow" and "deep" bedrock units.*

- *Figure 2-1 indicates the inferred extent of ground water contamination however the southwestern extent of shallow and deep bedrock contaminant distribution may extend beyond this inferred boundary since the location and number of monitoring wells in this southwest plume area may be insufficient.*

- *The Figures 1-13 through 1-16 depicting the extent of the PCE plume are based on ground water sampling data that is from 2006 and/or 2009/2010. This data should be updated with a more recent sampling round.*

- *The absence of ground water data in the area southwest of Building 81 may lead to an inadequate design of the bedrock remediation design under alternative G-3 and G-4.*

Response: While the 2006 and 2009-2010 RI field programs provided a significant amount of information the items noted in the comment are appropriate for consideration during the remedial design process and development of a pilot test for the selected remedy. Additional groundwater data would be collected to establish current conditions as part of the remedial design and assist in the preparation of the long-term monitoring program.